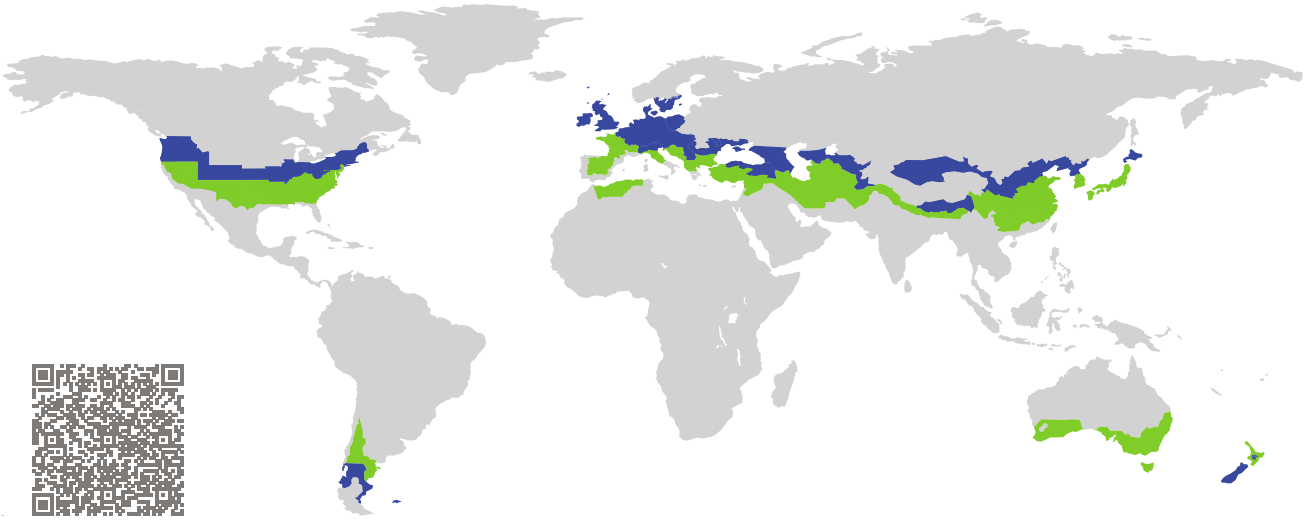
CERTIFICATE

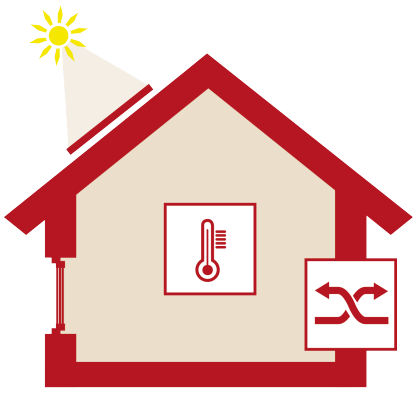
Certified Passive House Component

Component-ID 2352rn03 valid until 31st December 2025

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
Germany



Category:	**Renovation system**
Manufacturer:	**pro Passivhausfenster GmbH, Oberaudorf, Germany**
Product name:	**smartshell reno**
Construction type:	**Light (wood)**
Main insulation type:	**Cellulose**
Window product:	**smartwin solar HPL**



System includes wall and window modules plus roof modules and floor modules, plus ventilation, photovoltaics and heat pump

EnerPHit

CERTIFIED RENOVATION SYSTEM
Passive House Institute

pro Passivhausfenster GmbH
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Criteria

1.1 Hygiene criterion: Lowest interior surface temperature factor above 0.70?	✓
1.2 Airtightness concept: Comprehensive airtightness concept guide provided?	✓
2.1 Max. heat transfer coefficient: All U-values below climate zone-specific limit?	✓
2.2 SRI of external finishes: All solar reflectance indices above limit, where applicable?	N/A
2.3 Absence of thermal bridges: All Psi-values below limit, or sufficiently reduced?	✓
2.4 Condensation limit: Condensation evaporated within 12 month period?	✓
2.5 Ma limit: Moisture accumulation value below limit?	✓
3.1 Window comfort criterion: Uw-installed value below limit?	✓
3.2 SHGC / g-value of glazing: g-value of glazing below limit?	✓
3.3 External shading: External shading strategy for sun-facing windows provided?	✓
4 Ventilation system: Comprehensive ventilation concept document provided?	✓
5 Installation manual: Comprehensive installation guide provided?	✓
6 Occupant manual: Comprehensive use and maintenance guide provided?	✓

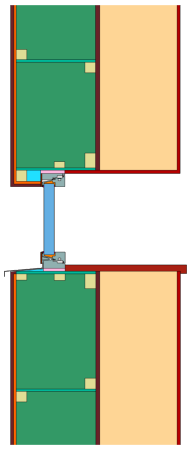
Summary of values

Opaque assemblies			U-value W/(m² K)	Thickness mm
exterior wall	(EW1)		0.11	802
floor slab	(FS1)		0.25	320
pitched roof	(RO1)		0.11	497
pitched roof	(RO2)		0.10	440

Frame Cuts with ”Smartwin Solar HPL” from ”pro Passivhausfenster GmbH” (2353wi03)					
Frame values			Frame width b_f mm	U-value frame U_f W/(m² K)	Ψ-glazing edge Ψ_g W/(m K)	Temp. Factor $f_{Rsi=0.25}$ [-]
Bottom	(OB1)		77	0.91	0.026	0.70
Top	(OH1)		62	0.86	0.026	0.71
Lateral	(OJ1)		62	0.86	0.026	0.71
Spacer: MULTITECH G				Secondary seal: Polysulfide		

Validated installations

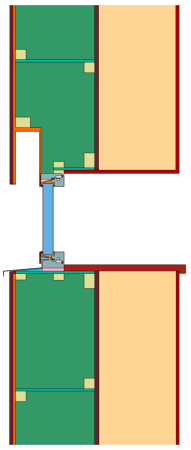
Lightweight timber (operable) 1



$\Psi_{install}$	W/(m K)
Top	0.012
Side	0.016
Bottom	0.025

$U_{W,installed}$ = 0.85 W/(m² K)

Lightweight timber (operable) 2

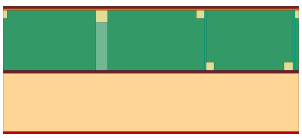


$\Psi_{install}$	W/(m K)
Top	0.041
Side	0.023
Bottom	0.025

$U_{W,installed}$ = 0.88 W/(m² K)

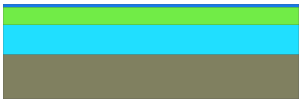
Opaque Assemblies

exterior wall (EW1)



Material	Lambda W/(m K)	Thickness (mm)
Interior plaster | Gipsputz 10456	0.570	15
Existing wall | Bestandgebäude	0.650	365
Lime mortar | Putzmörtel aus Kalk	1.000	20
Smartshell Eq. | Smartshell Äq.	0.045	375
Sto Ventec plaster baseboard | Sto Vente Putzträgerplatte	0.150	12
Lime mortar | Putzmörtel aus Kalk	1.000	15
Total thickness: 802 mm		
Rsi: 0.13 m² K/W		
Rse: 0.04 m² K/W		
U-value: 0.11 W/(m² K)		

floor slab (FS1)



Material	Lambda W/(m K)	Thickness (mm)
Concrete, 1% Steel | Beton, 1% Stahl	2.300	150
PU foam | PU-Schaum	0.027	100
Cement screed | Zement-Estrich	1.400	60
Artificial stone | Kunststein	1.300	10
Total thickness: 320 mm		
Rsi: 0.17 m² K/W		
Rse: - m² K/W		
U-value: 0.25 W/(m² K)		

pitched roof (RO1)

Material	Lambda W/(m K)	Thickness (mm)
Softwood I Weichholz	0.130	100
Smartshell Eq. | Smartshell Äq.	0.045	375
Softwood | Weichholz	0.130	22
	Total thickness: 497 mm	
	Rsi: 0.10 m^2 K/W	
	Rse: 0.10 m^2 K/W	
	U-value: 0.11 W/(m^2 K)	

pitched roof (RO2)

Material	Lambda W/(m K)	Thickness (mm)
Softwood I Weichholz	0.130	20
Smartshell Eq. | Smartshell Äq.	0.052	160
Softwood I Weichholz	0.130	20
EPS | Styropor	0.035	220
Softwood | Weichholz	0.130	20
	Total thickness: 440 mm	
	Rsi: 0.10 m^2 K/W	
	Rse: 0.10 m^2 K/W	
	U-value: 0.10 W/(m^2 K)	

Junctions	U1 U2 W/(m² K)	Ψ-value Ψ W/(m K)	Temp. factor $f_{Rsi=0.25}$ [-]
Ceiling integration into exterior wall (EW1_EW1_CE_1)	0.11 0.11	0.023	0.974
Ceiling integration into exterior wall (EW1_EW1_CE_2)	0.11 0.11	0.009	0.973
Exterior corner exterior wall (EW1_EW1_ec_1)	0.11 0.11	–0.072	0.930
Interior corner exterior wall (EW1_EW1_ic_1)	0.11 0.11	0.042	0.971
Internal wall integration into exterior wall (EW1_EW1_IW_1)	0.11 0.11	–0.008	0.973
Roof eave pitched roof (EW1_RO1_ea_1)	0.11 0.11	–0.037	0.940
Roof verge pitched roof (EW1_RO1_ve_1)	0.11 0.11	–0.087	0.924
Roof eave pitched roof (EW1_RO2_ea_2)	0.11 0.10	–0.016	0.942
Roof verge pitched roof (EW1_RO2_ve_2)	0.11 0.10	–0.083	0.934
Roof ridge pitched roof (RO1_RO1_ri_1)	0.11 0.11	–0.024	0.928
Roof ridge pitched roof (RO2_RO2_ri_2)	0.10 0.10	–0.033	0.948

Junctions

Ceiling integration

into exterior wall

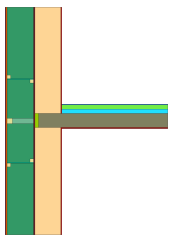
(EW1_EW1_CE_1)

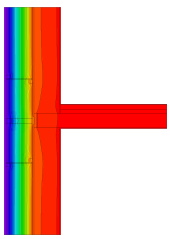
U_{EW1} = 0.11 W/(m² K)

U_{EW1} = 0.11 W/(m² K)

Ψ = 0.023 W/(m K)

f_{Rsi} = 0.974





Ceiling integration

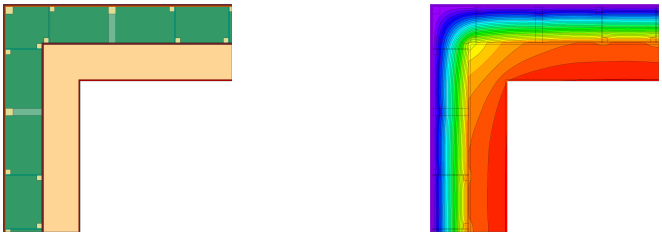
into exterior wall (EW1_EW1_CE_2)

U_{EW1} = 0.11 W/(m² K)
U_{EW1} = 0.11 W/(m² K)
Ψ = 0.009 W/(m K)
f_{Rsi} = 0.973

Exterior corner

exterior wall (EW1_EW1_ec_1)

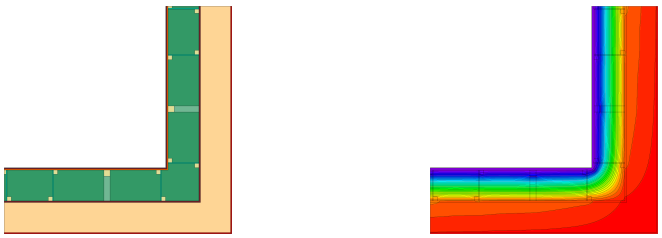
U_{EW1} = 0.11 W/(m² K)
U_{EW1} = 0.11 W/(m² K)
Ψ = –0.072 W/(m K)
f_{Rsi} = 0.930



Interior corner

exterior wall (EW1_EW1_ic_1)

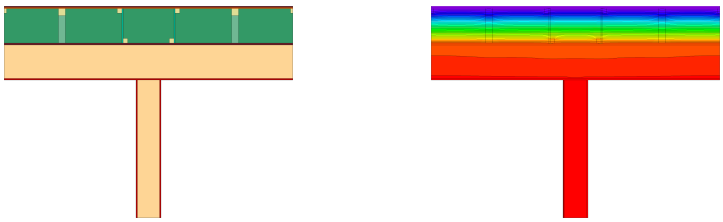
U_{EW1} = 0.11 W/(m² K)
U_{EW1} = 0.11 W/(m² K)
Ψ = 0.042 W/(m K)
f_{Rsi} = 0.971



Internal wall integration

into exterior wall (EW1_EW1_IW_1)

U_{EW1} = 0.11 W/(m² K)
U_{EW1} = 0.11 W/(m² K)
Ψ = –0.008 W/(m K)
f_{Rsi} = 0.973



Roof eave

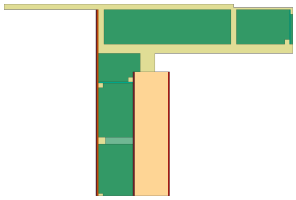
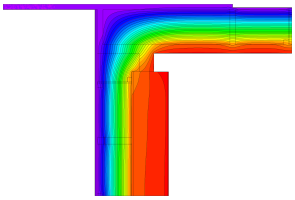
pitched roof (EW1_RO1_ea_1)

U_{EW1} = 0.11 W/(m² K)
U_{RO1} = 0.11 W/(m² K)
Ψ = –0.037 W/(m K)
f_{Rsi} = 0.940

Roof verge

pitched roof (EW1_RO1_ve_1)

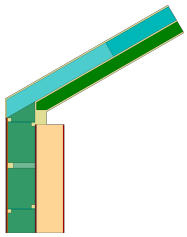
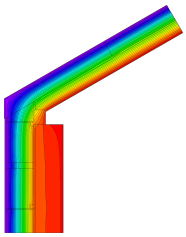
U_{EW1} = 0.11 W/(m² K)
U_{RO1} = 0.11 W/(m² K)
Ψ = –0.087 W/(m K)
f_{Rsi} = 0.924

Roof eave

pitched roof (EW1_RO2_ea_2)

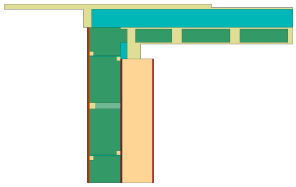
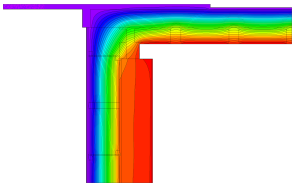
U_{EW1} = 0.11 W/(m² K)
U_{RO2} = 0.10 W/(m² K)
Ψ = –0.016 W/(m K)
f_{Rsi} = 0.942

Roof verge

pitched roof (EW1_RO2_ve_2)

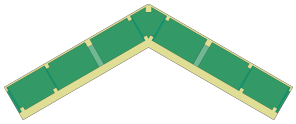
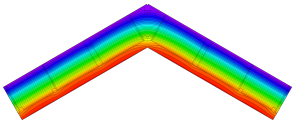
U_{EW1} = 0.11 W/(m² K)
U_{RO2} = 0.10 W/(m² K)
Ψ = –0.083 W/(m K)
f_{Rsi} = 0.934

Roof ridge

pitched roof (RO1_RO1_ri_1)

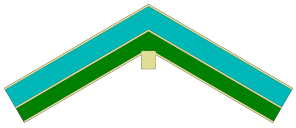
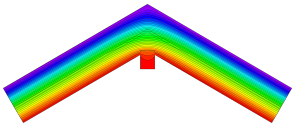
U_{RO1} = 0.11 W/(m² K)
U_{RO1} = 0.11 W/(m² K)
Ψ = –0.024 W/(m K)
f_{Rsi} = 0.928

Roof ridge

pitched roof (RO2_RO2_ri_2)

U_{RO2} = 0.10 W/(m² K)
U_{RO2} = 0.10 W/(m² K)
Ψ = –0.033 W/(m K)
f_{Rsi} = 0.948

System description
The Smartshell Reno renovation system from Pro Passivhausfenster GmbH is an innovative solution designed for retrofitting existing buildings to enable achievement of the EnerPHit standard. The system comprises pre-fabricated structures with pre-installed Smartwin Solar HPL windows, which are installed over window reveals, fitted in the window production. Prefabricated cassettes constructed from timber Z-profiles are then installed to the walls and roof of the existing building and connected to the window sections using Sto Ventec plaster underlay plates, which are then covered with lime plaster. The resulting cavities are then filled with cellulose insulation (0,040 W/(mK)). The existing floor is insulated with PU foam (0,027 W/ (mK)) and the basement ceiling is also insulated with XPS foam (0,037 W/ (mK)). The airtight layer of the system is created from a layer of lime cement plaster located between the existing structure and the Smartshell Reno system.

Window description
The Smartwin Solar HPL window is a variant of the standard Smartwin Solar window, but rather than an aluminium weather profile to the exterior, a high-pressure laminated (HPL) plate is used. The main window profile is made from spruce/fir (0,11 W/(mK)) and insulated with natural insulation (0,040 W/(mK)). Glass loads are carried by special corner pieces. The airtightness test was conducted on a combination of fixed glazing and tilt and turn sash, element size 2.0 x 2.6 m. Pane thickness: 48 mm (4/18/4/18/4), rebate depth: 15 mm. Spacer: MULTITECH G with polysulfide secondary seal.

Airtightness concept
The Smartshell Reno renovation system enables achievement of the high degree of airtightness required for the EnerPHit standard. In general, this is achieved either by upgrading the external plaster, or by using suitable airtightness membranes and tapes. A full airtightness concept has been provided, and a summary is given in the certification report.

Ventilation concept
The Smartshell Reno renovation system uses the Smartvent heat recovery ventilation system, also manufactured by ProPassivhausfenster GmbH, to enable the level of ventilation required by the EnerPHit standard. A full ventilation concept has been provided, and a summary is given in the certification report.

Heating concept
The Smartshell Reno renovation system uses NIBE heat pump units to provide heating to refurbished dwellings. Depending on the configuration and location of the scheme, the units can take the form of air- or ground-source systems. A full heating concept has been provided, and a summary is given in the certification report.

Additional services

The following services are offered by for the smartshell Reno 2024 system:

Service	Description
Design & consulting	Propassivhausfenster GmbH provides design and consulting services as standard for all projects.
On-site generation	The Smartshell system can be integrated seamlessly with on-site energy generation systems
Quality assurance & monitoring	Pro Passivhausfenster GmbH offers close involvement with all projects, with quality assurance services offered as standard, and ongoing monitoring offered as an additional service.
Heating, DHW and cooling compatibility	Heat pump systems can be seamlessly integrated into the Smartshell Renovation system, offering both heating and cooling.