



Pilkington **Sunplus™** BIPV

Pilkington **Sunplus™** BIPV provides renewable power generating architectural glass solutions for building facades, windows, roof glazing, etc. with a high degree of transparency or full spandrel PV elements, combining efficiency and design.

BIPV stands for Building Integrated Photovoltaics (BIPV) and refers to a building component which has been enhanced to perform as a renewable energy generating material in addition to being an integrated part of the architecture and building façade. Examples include windows, sunshades, spandrel glass and skylights.

Our latest development Pilkington **Sunplus™** BIPV, provides power generating, architectural glass solutions for both vertical and horizontal applications, allowing building proprietors and developers to turn buildings into power-generating assets. Pilkington **Sunplus™** BIPV combines the proven reliability and efficiency of crystalline silicon technology with - aesthetics, design, quality, performance and our expertise in glass. A range of products to support the transition to sustainable buildings with smart glass facades and to reach zero energy buildings.

PV Vision

PV Vision refers to Pilkington **Sunplus™** BIPV with a high degree of transparency. It can be supplied in either a single laminated format or as an integrated Insulating Glass Unit (IGU); providing a unique combination of attractive aesthetics, effective daylighting, superior thermal performance and high power density.

Key Benefits

- **Seamless Integration:** Pilkington **Sunplus™** BIPV is designed for ease of integration into the design of a building, allowing for desired combination of aesthetics and performance.
- **Custom Design:** Partial and full layout of PV-cells allow for flexible design.
- **Reliability:** Pilkington **Sunplus™** BIPV uses proven monocrystalline silicon PV cell technology for quality, durability, and performance.
- **Attractive Aesthetics:** Elegant solutions to show renewable energy generation in harmony with transparency, privacy and functionality of the window.
- **Sustainability:** Pilkington **Sunplus™** BIPV can assist with the with LEED and BREEAM certification process towards a Net-Zero Building, improving the sustainability credentials of a building.
- **Compelling Economics:** In addition to the value of renewable electrical energy generation, cost reduction could be possible by:
 - downsizing of HVAC system,
 - minimizing blinds and sunshades,
 - reduced operating costs,
 - possibility of incentives for PV available to both property owners and building developers.
- **Certification:** Modules have been tested – by KIWA according to:
 - IEC 61215:2005 / EN 61215:2005 Crystalline silicon terrestrial PV modules (Design qualification and type approval),
 - IEC 61730-1:2013 / EN 61730-1/A2:2013 PV module safety qualification (Requirements for construction),
 - IEC 61730-2:2012 / EN 61730-2/A1:2012 PV module safety qualification (Requirements for testing).

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Indoor perspective.

Reference Design Electrical data

Dimensions	
Length	1588 mm
Width	1020 mm
Electrical Specification	
Power P_{max}	140 W
Efficiency	9.6%
Open Circuit Voltage (V_{oc})	46.8 V
Short Circuit Current (I_{sc})	3.9 A
Max Power Voltage (V_{mp})	38.8 V
Max Power Current (I_{mp})	3.6 A
Temperature Performance	
Coefficient of P_{max}	-0.40%/°C
Coefficient of V_{oc}	-0.30%/°C
Coefficient of I_{sc}	-0.05%/°C
Material Specification	
PV Type	Monocrystalline
PV Strip	10.85 × 156.75 mm
PV Gap	10.85 mm
PV Coverage	Typically 50%, depending on module dimensions (except in edge area)
Interlayer	PVB
Junction Box	Edge Mounted

Indicative data depending upon module design. Dimension and performance values of PV-Strips can vary with changes in related PV-Cell dimensions.

PV Module Design Constraints

PV Module	
Typical PV Laminate Thickness	9.5 mm
Recommended Min IGU Thickness*	30 mm
Weight	21 kg/m²
Junction Box	
Junction Boxes Per Module	Variable

* Value corresponds to a 9.5 mm outboard laminate assembled to a 4 mm inboard lite.



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PV Module and Junction Box

The junction box is attached to the edge of the module and the number of junction boxes will depend on the design and associated electrical parameters. Where one junction box is required it will be placed in the middle of one side of the unit. Where two junction boxes are required, they are placed approximately at a 1/3 and 2/3 across a length side of the module.



PV Module with junction box (edge connector) and junction box.

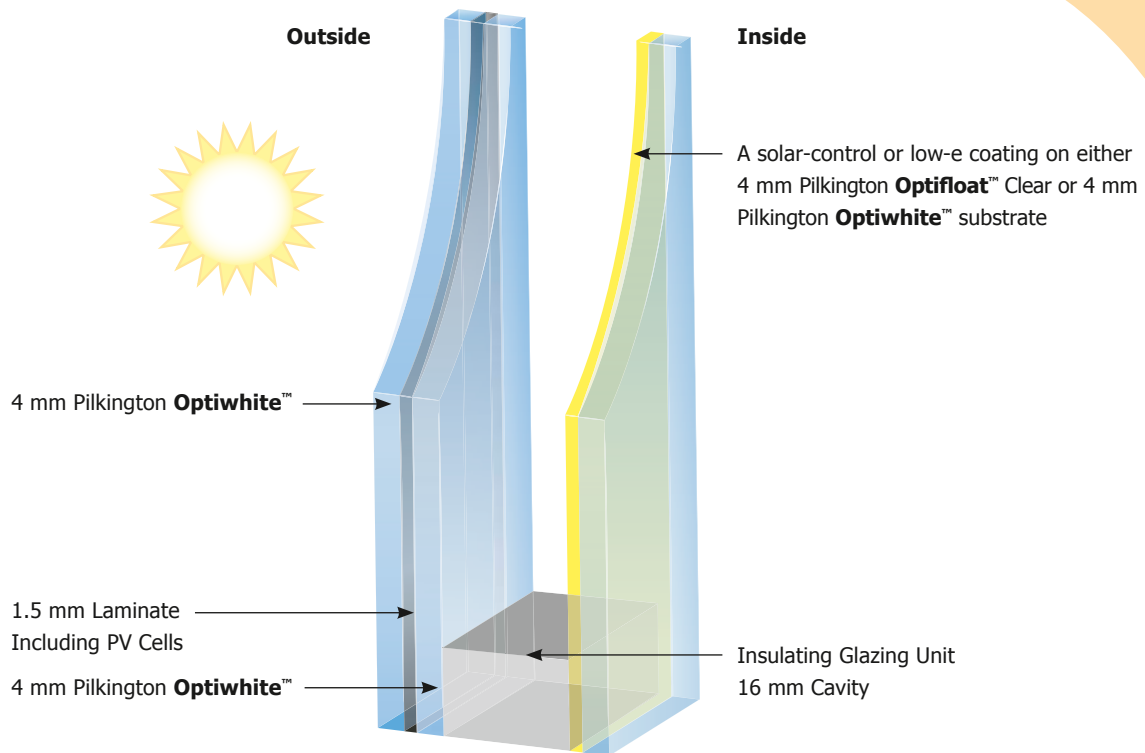


Optical and Thermal Performance

Pilkington **Sunplus™** BIPV can be customized to offer optimum values in light transmittance and solar heat control (g-value). When forming part of an IGU it reaches thermal insulation state-of-the-art performance.

How it works

Pilkington **Optiwhite™**, an extra-clear float glass, allows maximum solar energy transmission which the crystalline silicon PV cells in the laminate convert into electricity.



Insulating Glass Unit incorporating Pilkington **Sunplus™** BIPV and coated solar control or low-e glass.

Optical modelling examples according to EN 410/EN 673

Product	LT (%)	LR _{out} (%)	ER (%)	g-value (%)	U _g [W/m²K]
Pilkington Sunplus™ BIPV	46	7	7	53	5.4
Pilkington Sunplus™ BIPV in IGU					
Pilkington Optitherm™ S3 DGU 9.5BIPV/16Ar/4S3	41	8	11	34	1.1
Pilkington Optitherm™ S1A DGU 9.5BIPV/16Ar/4S1A	38	9	14	29	1.0
Pilkington Optitherm™ S3 TGU 9.5BIPV/12Ar/4S3/12Ar/4S3	37	9	11	29	0.7

NSG Group can assist with the optical modelling using different combinations.

PV Spandrel and Spandrel Décor

PV Spandrel is the name given to Pilkington **Sunplus™** BIPV when it is supplied in a spandrel BIPV solution. With full PV cell coverage, the spandrel product is an architecturally appealing, high power density, opaque solution with approximately 18% module efficiency. The PV spandrel and Décor variants are designed to complement the semi-transparent Pilkington **Sunplus™** BIPV (PV Vision), increasing the overall energy performance of the building.

Décor variant can offer vast and new opportunities for architects to combine aesthetics with great performance PV panels for the solar architecture. Simply combine solar function and economy with aesthetics and make more out of facades with Pilkington **Sunplus™** BIPV.

Key Benefits

The Pilkington **Sunplus™** BIPV Spandrel solutions provide all the PV Vision benefits, as well as:

- delivers high power density combined with appealing aesthetics and design options,
- can be effectively integrated into the design of a building on its own, or combined with PV Vision enabling higher glass to wall ratio.
- flexible design layout of cells is possible as well in a range of colours, to suit custom aesthetic requirements.



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Reference Design Electrical Specification

Dimensions	
Length	1444 mm
Width	988 mm
Electrical Specification	
Power P _{max}	195 W
Efficiency	18.9%
Open Circuit Voltage (V _{oc})	22.2 V
Short Circuit Current (I _{sc})	11.4 A
Max Power Voltage (V _{mp})	18.3 V
Max Power Current (I _{mp})	10.4 A
Temperature Performance	
Coefficient of P _{max}	−0.40%/°C
Coefficient of V _{oc}	−0.30%/°C
Coefficient of I _{sc}	−0.05%/°C
Materials Specification	
PV Type	Monocrystalline
PV Strip	39 × 156.75 mm
PV Coverage	Typically 90%, depending on module dimensions (except in edge area)
Interlayer	EVA or PVB
Junction Box	Edge Mounted

Indicative data depending upon module design. Dimension and performance values of PV-Strips can vary with changes in related PV-Cell dimensions.

PV Module Design Constraints

PV Module	
Typical PV Laminate Thickness	11.5 mm
Weight	26 kg/m²
Junction Box	
Junction Boxes Per Module	Variable

Manufacturing Excellence

Pilkington **Sunplus™** BIPV is combined with the latest technologically advanced glass from the Pilkington glass range. We use the latest technology combined with over a 100 years of manufacturing experience and processing glass to deliver fault-free, clear and durable end products. After the lamination process the module is as robust as a normal glass laminate and can be processed into an IGU, which is then installed in a window frame.



Customised PV spandrel in grey colour.

Design Flexibility

Pilkington **Sunplus™** BIPV solutions can be customized to achieve desired combinations of aesthetics, thermal performance, effective daylighting, and power generation. The layout of the strings can be tailored or hidden to support aesthetics and performance of the desired application.

Pilkington **Sunplus™** BIPV can contribute to reach sustainable buildings and to comply with Nearly Zero-Energy Building (NEZB) requirements. The products can be delivered in different dimensions for a variety of applications across the building skin, both vertically and horizontally. The dimensions and lay-out of the strings will ultimately determine the electrical parameters of the module. NSG Group can provide assistance throughout the module design process and support in the energy yield estimate of the building by supplying energy prediction models.



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The Declaration of Performance for each product, including declared values, can be found at www.pilkington.com/CE



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