

A close-up photograph of a green palm frond, showing the intricate vein structure. The frond is oriented diagonally, with the central rachis on the left. The background is a soft-focus green. A thin white border frames the entire image.

Achieving BREEAM credits with advanced glazing products from NSG Group

NSG
GROUP

BREEAM is the world's most widely used environmental assessment method for buildings. In this publication, we describe how NSG Group products can help in achieving BREEAM certification by category.

Energy Category

Reduction of CO₂ Emissions

Aim: To recognise and encourage buildings that are designed to minimise the CO₂ emissions associated with their operational energy consumption.

This aim can be achieved by the use of energy saving, low-emissivity and solar control glass, for best performance, used within a double or triple Insulating Glass Unit (IGU).

In cold climates, low-emissivity glass prevents heat escaping the building, while still allowing solar heat to enter it. Glass with the lowest U_g -value (the measure of heat loss expressed as W/m^2K , which is the rate of heat loss in Watts per square metre per degree Kelvin temperature difference between inside and outside) will provide the best insulation. Furthermore, in cold but sunny climates, glass achieving the highest g value, also called the passive solar heat gain (the proportion of solar radiation transmitted through the glass by all means) will help to reduce further the need for heating the inside of a building.

We have a range of low-emissivity glasses to cover all levels of requirements.

- Pilkington **Energy Advantage™** and Pilkington **K Glass™** are on-line coated glasses offering medium thermal insulation performance. Although they can be used in their monolithic form, they will provide the highest thermal insulation when used in an IGU, achieving a U_g -value of $1.5 W/m^2K$ when used in a standard double IGU. At the same time they will provide the highest degree of passive solar heat gain, free energy from the sun (up to 72% for Pilkington **K Glass™**).
- Pilkington **Optitherm™** is a range of off-line coated glasses which offer the highest performances of thermal insulation. These products will provide U_g -values from as low as $1.0 W/m^2K$ (Pilkington **Optitherm™ S1**) when used in a standard double IGU and $0.6 W/m^2K$ (Pilkington **Optitherm™ GS**), when used in a triple IGU. Pilkington **Optitherm™ GS** has been specially designed to exceed Passiv Haus specifications, offering at the same time high g value and light transmittance (respectively 61% and 73%). It is possible to achieve a lower U_g -value of $0.4 W/m^2K$ in a triple IGU with Pilkington **Optitherm™ S1**; in this case there would be a compromise on the g value and the light transmittance (respectively 36% and 56%). Pilkington **Optitherm™ S3** is the most popular of the three, offering a U_g -value of $1.1 W/m^2K$ when used in a standard double IGU. In addition to its very high light transmittance and low light reflectance, it offers a high level of neutrality, making it ideal for large glazed areas with demanding design.

The choice of glass combination will depend on the performances required, as well as the building location, orientation and area of glass.

Balancing historical preservation with modern comfort and environmental requirements can be challenging. As historical buildings were constructed

at a time when energy efficiency was not a concern, bringing them up to today's standard could sometimes mean compromising their integrity. Pilkington **Spacia™** is the world's first commercially available vacuum glazing; it offers the thermal performance of a conventional double IGU. Despite being no thicker than a single pane of glass it has a U_g -value of $1.4 W/m^2K$ in a 6 mm construction. It allows fitting replacement windows that are more in keeping with the original design, as well as it may even allow the use of the original frames if these are in a reasonable or repairable condition.

In warm climates, solar control glass minimises heat entering the building, while still letting lots of natural daylight in. The best energy-efficient glazing combines solar control and thermal insulation in an IGU to enhance the performance, by reducing heat gain from direct solar radiation into the building due to the lower g value, and conduction gains through the IGU from the hot outside environment to the air-conditioned inside.

The combination of solar control and low-emissivity in an IGU will help to reduce air-conditioning loads, save energy and reduce CO₂ emissions. This can be achieved by either using a single product which provides both solar control and low-emissivity in an IGU, or using a solar control product and a separate low-emissivity product within an IGU.

Pilkington **Suncool™** is a range of superior off-line coated solar control products with a wide range of visible light transmittance, reduced solar transmittance and excellent low-emissivity, all in one product. The products range from 30 up to 71% light transmittance whilst achieving U_g -values down to $1.0 W/m^2K$, and g values as low as 19% in standard double IGUs. The excellent solar control properties of Pilkington **Suncool™** greatly reduce the need for air-conditioning and artificial lighting within a building, whilst its insulation properties can reduce heat loss, helping significantly to reduce the operational energy consumption of the building.

Pilkington **Solar-E™** and Pilkington **Eclipse Advantage™** are on-line coated solar control performance glass with low-emissivity properties too. They can achieve g values ranging down to 28% and U_g -values of $1.5 W/m^2K$ in a standard double IGU. They can be combined with a low-emissivity glass in an IGU to provide further improved thermal insulation.

Pilkington **Eclipse™ Gold**, Pilkington **SunShade™ Silver**, Pilkington **Reflite™** and high performance tinted glasses such as Pilkington **Arctic Blue™** are medium solar control products.

To provide thermal insulation, they have to be combined in an IGU with a low-emissivity glass such as Pilkington **Optitherm™**, Pilkington **K Glass™** or Pilkington **Energy Advantage™**.

Using double or triple IGUs such as Pilkington **Insulight™** or Pilkington **energikare™** (UK only) range of product will improve the thermal insulation of the window and therefore reduce the operational energy consumption of the building. As well as the type of glass used, the cavity (space between the panes filled with air or gas) and the frame will also have an influence on the overall performance of a window.

Materials Category

Low or Zero Carbon Technologies

Aim: To reduce carbon emissions and atmospheric pollution by encouraging local energy generation from renewable sources to supply a significant proportion of the energy demand.

Solar panels can help achieve this aim as they can be used to harness solar energy and supply buildings with electricity and heat. Glass is an integral and important element of most solar technologies currently available.

We offer a wide range of high-tech glass products, which can be used in all of the leading solar technologies, including thin film photovoltaics, crystalline silicon photovoltaics, concentrated solar power applications and solar thermal collectors.

NSG **TEC**™ is a group of products, including a comprehensive range of TCO (Transparent Conductive Oxide) coated glass, optimised to suit a variety of thin film photovoltaic technologies.

Pilkington **Optiwhite**™ extra-clear low-iron range of glass may also be used as cover plates for thin film and crystalline silicon photovoltaic modules, as well as in solar thermal collectors. Due to their very high light transmittance (up to 92%) and solar transmittance (solar direct transmittance of up to 91%), the products are very often used in concentrated solar power applications too.

Pilkington **Sunplus**™ low-iron rolled range of glass is used extensively for the cover glass in crystalline silicon photovoltaic modules and in solar thermal collectors.

Materials Specification

Aim: To recognise and encourage the use of construction materials with a low environmental impact over the full lifecycle of the building.

The BRE environmental profiles scheme calculates embodied environmental impacts for elements for which credits are available. The use of Pilkington **energiKare**™ (UK only) or Pilkington **Insulight**™ Therm IGUs in commercial windows can help to achieve a Green Guide rating of up to A+ (dependent upon frame material).

Note. Our glass contains 28% of recycled material on average; this helps us improve our manufacturing efficiency.

Responsible Sourcing of Materials

Aim: To recognise and encourage the specification of responsibly sourced materials for key finishing elements (includes windows).

All our glass manufacturing and commercial processing sites have an environmental management system certified to ISO 14001. This meets the requirements of tier level 4.

In the UK the majority of our sand and soda ash raw material suppliers are certified to ISO 14001. This meets the requirements of tier level 3.

Outside of the UK we are working with a growing number of suppliers to achieve certification in the future. In the interim period a programme is now underway to assess the current environmental controls they are operating to and where necessary implement improvement plans to ensure they are operating to the principles of ISO 14001.

Note. The ISO 14001 certificate for our manufacturing sites is available on our website at www.nsg.com/iso14001.

Health & Wellbeing Category

Daylighting and View Out

Aim: To give building users sufficient access to daylight. To allow occupants to refocus their eyes from close work and enjoy an external view.

Increased glazed areas can help to achieve this aim.

Advances in glass technology have made it possible to create vibrant interiors that connect the users with the outside world. Glass is multi-functional; it can be used in vertical or roof applications, providing the same properties as any solid material, i.e. comfort, safety and/or security, as well as natural light and a view to the outside.

We offer several glass products with high light transmittance to maximise daylight. Pilkington **Optifloat™** Clear is our high quality clear float glass; it has a light transmittance of 90% in 4 mm. Pilkington **Optiwhite™** is our extra-clear low-iron glass that offers high light transmittance and clarity of view; its light transmittance is 92% in 4 mm.

Furthermore, our low-emissivity glasses also offer medium-to-high light transmittance in addition to their low U_g -value as stated earlier (see also Energy Category – Reduction of CO₂ Emissions).

IGUs made of Pilkington **Optitherm™** range of products can still achieve 80% light transmittance in double IGUs and as much as 73% in triple IGUs.

Along with their excellent solar control and low-emissivity properties, the Pilkington **Suncool™** products offer a range of light transmittance up to 71% in a double IGU. When combined with Pilkington **Optiwhite™** extra-clear low-iron glass, they can achieve up to 73% light transmittance in a double IGU.

The use of Pilkington **Activ™** in vertical glazing, rooflights and skylights can help to ensure high levels of daylight transmittance, by providing an external glass surface free from dirt for longer periods than in the case of ordinary glass. At the same time condensation is reduced.

We also offer a range of glass systems. Pilkington **Planar™** structural glazing system and Pilkington **Profilit™** U-shaped cast glass allow designers and specifiers to transform courtyards into cosy interiors, enclose private and public outdoor areas under glass roofs and build stunning glass façades. They help create building interiors which connect occupants with the external environment, combining unbroken views of the surrounding nature and high level of natural light with the comfort and safety of the internal environment.

Pilkington **Planar™** can be combined with any glass from the Pilkington range therefore providing the same light transmittance as any other glazing.

Translucent rather than transparent, Pilkington **Profilit™** can offer up to 75% light transmittance in double skin applications while still providing

impact safety. This product is ideal in applications such as sports centres which tend to lack of natural daylight, as impact safety concerns normally restrict glazed areas.

Surprisingly, there are currently no credits available for fire safety. However, where other requirements (e.g. building regulations) dictate that fire resistance should be provided, the use of clear fire protection glass can help to maximize daylight. Our range of fire-resistant products, Pilkington **Pyrostop®**, Pilkington **Pyrodur®** and Pilkington **Pyroclear®** help to provide a protected, yet comfortable and versatile state-of-the-art glazed building environment, founded on daylighting and clear vision complying with relevant fire safety regulations, avoiding non-transparent solid roofs, doors and partitions which block out views and natural light.

Glare Control

Aim: To reduce problems associated with glare in occupied areas through the provision of adequate controls.

This aim can be achieved by the use of solar control glass, often in conjunction with other shading devices such as blinds.

Although not the only factor associated with the control of glare, glass with low light transmittance can help. Products such as Pilkington **Suncool™** 40/22, Pilkington **Suncool™** 30/17, Pilkington **Solar-E™**, Pilkington **Eclipse Advantage™** and Pilkington **Reflite™** in their tinted versions, as well as some of our Pilkington **Optifloat™** Tint and high performance tinted products do provide light transmittance ranging from 15% up to 49% when used in a standard double IGU. If these products are combined in an IGU with a low-emissivity product such as Pilkington **K Glass™**, Pilkington **Energy Advantage™** or one of the Pilkington **Optitherm™** glasses, light transmittance will decrease further.

Management Category

Sound Insulation and Noise Attenuation

Aim: To reduce the likelihood of noise from the new development affecting nearby noise-sensitive buildings. To ensure the acoustic performance of the building meets the appropriate standards for its purpose. To ensure the provision of sound insulation to reduce the likelihood of noise complaints from neighbours.

This aim can be achieved by the use of noise control glass.

We can improve the sound insulation of glass in different ways - increasing the thickness of the pane, using laminated glass on its own or within an IGU (the larger the gap between the panes, the better the insulation). The best performance is however obtained when using an acoustic laminated glass, Pilkington **Optiphon™**, and for the highest noise insulation, within an IGU, Pilkington **Insulight™** Phon.

Pilkington **Optiphon™** is a high quality acoustic laminated glass that offers excellent noise reduction without compromising on light transmittance or impact performance. It can provide dwellings with enhanced sound insulation from external noise sources such as road, rail or air traffic, neighbouring dwellings, factories, schools or nightclubs. IGU combinations can achieve R_w values of over 50 dB.

Security

Aim: To recognise and encourage the implementation of effective design measures that will reduce the opportunity for fear of crime on the new development.

This aim can be achieved with the use of security glazing.

Pilkington **Optilam™** security glass is produced by combining layers of glass with polyvinylbutyral (PVB) interlayers to form sandwiches of material with specific design properties ensuring security in addition to its safety properties. The interlayers ensure the integrity of the glass by holding the broken pieces in place should any damage occur. In fact, glass fragments adhere strongly to the interlayer, while the resistant cushioning effect dissipates the energy.

Product such as Pilkington **Optilam™** 7.5 mm meets Class P4A of EN 356 (resistance to manual attack); Pilkington **Optilam™** 39 mm meets Class P8B of EN 356, as well as Class BR4S to EN 1063 (bullet resistance).

We offer a wide choice of products fulfilling a multitude of functional requirements in buildings such as shops which display valuable goods, banks, building societies, museums, as well as in hospitals and prisons. For a given application, Pilkington **Optilam™** can be specified to offer safety, security, bullet resistance or blast resistance, also in combination with thermal insulation, noise control, solar control, etc...



Water Category

Water Consumption

Aim: To minimise the consumption of potable water in sanitary applications by encouraging the use of low water fittings.

The use of Pilkington **Activ™** self-cleaning glass can help to reduce the amount of mains water used for cleaning windows. A BRE report¹ quantifies the potential operational benefits from using Pilkington **Activ™** self-cleaning glass, taking into account social, economic and environmental aspects.

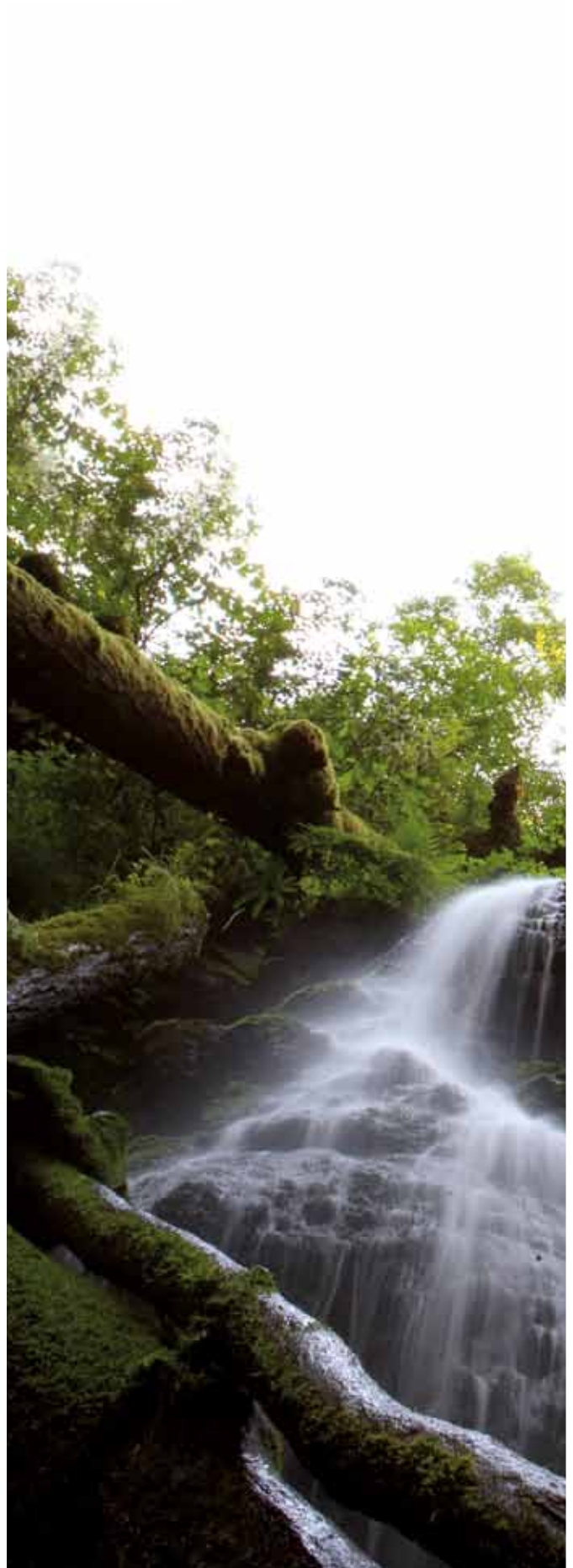
¹ BRE Report 'Pilkington **Activ™** Research Project: The quantification and evaluation of the benefits of self-cleaning glass,' (Report number 229724, September 2006).

Waste Category

Construction Site Waste Management

Aim: To promote resource efficiency via the effective management of construction site waste.

We aim to eliminate or minimise the amount of packaging used to deliver products to customers. Specialised floatliner vehicles are used where possible to eliminate the need for packaging. Returnable metal and a small proportion of recyclable wooden stillages are used where this is not possible. Cardboard spacers can be returned to and reused by the sites. Glass delivered to the construction site is already cut-to-size meaning that there is no additional contribution to waste at site.



About BREEAM

BREEAM (Building Research Establishment Environmental Assessment Method) is a widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and is used to describe a building's environmental performance.

BREEAM can be used to assess the environmental performance of any type of building (new and existing). Standard versions exist for common building types, and less common building types can be assessed against tailored criteria under the Bespoke BREEAM version. Buildings outside the UK can also be assessed using BREEAM International.

BREEAM provides clients, developers, designers and others with:

- Market recognition for low environmental impact buildings;
- Assurance that best environmental practice is incorporated into a building;
- Inspiration to find innovative solutions that minimise the environmental impact;
- A benchmark that is higher than regulation;
- A tool to help reduce running costs, improve working and living environments;
- A standard that demonstrates progress towards corporate and organisational environmental objectives.

BREEAM assesses buildings against a set of criteria across 8 categories and provides an overall score which will fall within a band providing either a; PASS, GOOD, VERY GOOD, EXCELLENT or OUTSTANDING rating.

For more information on BREEAM please visit www.breem.org

Please note that the information in this publication relates to BREEAM 2008

About NSG Group

The mission of the NSG Group is to be the global leader in innovative high performance glass and glazing solutions, contributing to energy conservation and generation, working safely and ethically.

Founded in 1918, Nippon Sheet Glass Co., Ltd. acquired the leading UK-based glass manufacturer Pilkington plc in June 2006. Today, the NSG Group has combined sales of around €5 billion, with manufacturing operations in 29 countries and sales in 130 countries, employing some 29,300 people worldwide.

The Group is one of the world's leading manufacturers of glass and glazing systems in three major business areas; Building Products, Automotive and Specialty Glass.

For more information about NSG Group please visit www.nsg.com

For more information on the products described in this document, please consult our "Product Annex: Glass for Sustainable Buildings", or visit our website www.pilkington.com

To find out about the key properties of our products in single glazing and insulating glass units please visit www.pilkington.com/spectrum for EN properties or www.pilkingtoncalculators.com for US properties.

The products described herein can all make a positive contribution to the sustainability of a building, as quantified in rating schemes such as LEED, BREEAM and the Code for Sustainable Homes. They are organised by benefit category throughout. For more information visit our website at www.pilkington.com

Product Annex: Glass for Sustainable Buildings

Solar Control

Pilkington Optifloat™ Tint and **Pilkington High Performance Tint** (e.g. **Pilkington Arctic Blue™**) is a range of low to medium solar control performance uncoated body-tinted glass, with low light reflection and high energy absorption.

The products are particularly suitable for applications that demand solar control without the use of surface coatings, for residential or commercial applications. To achieve thermal insulation, the products have to be combined with low-emissivity glass in Insulating Glass Units.

Pilkington Reflite™ is a range of medium solar control performance on-line coated clear or body-tinted glasses, with low light transmittance and medium light reflectance. The products are available in a range of colours (Clear, Arctic Blue, Emerald Green, Bronze and Grey).

Suitable for single glazing or incorporated in Insulating Glass Units, the products can be used in a wide range of residential and commercial applications. To achieve thermal insulation, the products have to be combined with low-emissivity glass in Insulating Glass Units.

Pilkington Eclipse™ Gold is a medium solar control performance on-line coated glass in a rich gold colour.

Suitable for single glazing or incorporated in an Insulating Glass Unit, the product can be used in a wide range of residential and commercial applications. To achieve thermal insulation, it has to be combined with low-emissivity glass in an Insulating Glass Unit.

Pilkington SunShade™ Silver is a medium solar control performance off-line coated glass, with low light transmittance and high light reflectance.

It is ideal for use in commercial façades as well as residential applications in hot climates with intense solar glare and sunlight. The product has to be used within an Insulating Glass Unit. To achieve thermal insulation, the product has to be combined with low-emissivity glass in an Insulating Glass Unit.

Pilkington Eclipse Advantage™ is a range of good solar control performance on-line coated clear or body-tinted glasses, with unique colours (Clear, Arctic Blue, Blue-Green, Bronze, EverGreen and Grey) and low-emissivity properties.

Specifically designed for use in countries with a warm climate, well-suited to both commercial façades and residential applications, the products offer unique colour options for original and innovative architecture designs. Extremely versatile, they can be used in their monolithic form or in Insulating Glass Units. The products can be combined with other low-emissivity glasses in Insulating Glass Units to achieve even higher levels of thermal insulation.

Pilkington Solar-E™ is a range of good solar control performance on-line coated glasses, with medium light transmittance, low light reflectance and low-emissivity. The products are available in a range of colours (Clear, Arctic Blue, EverGreen, Blue-Green and Grey).

They are well-suited to both commercial façades and residential applications where high reflectance is undesirable and energy-efficiency in both summer and winter is required. Extremely versatile, they can be used in their monolithic form or in Insulating Glass Units. The products can be combined with other low-emissivity glasses in Insulating Glass Units to achieve even higher levels of thermal insulation.

Pilkington Suncool™ is a range of superior solar control performance off-line coated glasses, with high light transmittance, low, medium or high light reflectance and outstanding thermal insulation (U-value down to 1.0 W/m²K in a double Insulating Glass Unit with 90% argon filled). The wide range of products is available in clear or neutral appearance and in two distinctive colours, blue and silver. They have been designed to be used in Insulating Glass Units. All products are available in combination with other products from the Pilkington range to offer additional benefits such as self-cleaning, safety/security or noise control. They can also be manufactured on **Pilkington Optiwhite™** low iron substrate to reduce the risk of thermal breakage and enhance the solar heat and light transmittance.

Designed to achieve optimum performance in large glazed areas, **Pilkington Suncool™** products are suitable for commercial and residential applications that demand high light transmission properties. The high selectivity index (light-to-heat ratio) combined with outstanding thermal insulation makes the range ideally suited for large areas of glazing, where the need is to control solar gain without significantly reducing the internal light level.



Solar Energy

NSG TEC™ is a group of products, including a comprehensive range of TCO (Transparent Conductive Oxide) coated glass, optimised to suit a variety of thin film photovoltaic technologies, with different haze and conductivity levels. All our **NSG TEC™** products are manufactured using a patented chemical vapour deposition process to produce a durable, on-line coating that may be heat strengthened or fully tempered, providing complete flexibility for module production. Each of our products within the range is targeted at a particular thin film photovoltaic technology. Our **NSG TEC™** products are available in either standard or low iron glass composition depending on the substrate/coating combination.

Pilkington Optiwhite™ is an ultra clear float glass with a very low iron content, which maximises the solar energy transmittance and, therefore, the efficiency of the module. Our range of products includes the standard and well established low iron **Pilkington Optiwhite™** and its new version, developed especially for the solar industry, **Pilkington Optiwhite™ S**, which offers even greater solar transmission. **Pilkington Microwhite™** is our **Pilkington Optiwhite™** in its extremely thin version (glass thicknesses down to 1.0 mm).

Because of their very high light transmittance and low absorptance **Pilkington Optiwhite™** and **Pilkington Microwhite™** are particularly suited to concentrator solar power technology too (i.e. solar mirrors).

Pilkington Sunplus™ is a glass specifically developed for use in crystalline silicon modules. This high performance low iron glass has very high solar energy transmittance. When toughened, its strength and durability make it the ideal choice for this application.

Our range of **Pilkington Sunplus™** products include:

Pilkington Sunplus™ SM: ultra high solar energy transmittance and low light reflectance due to a combination of a prismatic pyramidal pattern on one surface - S -, and a matt pattern on the other - M -;

Pilkington Sunplus™ MM: ultra high solar energy transmittance and low light reflectance due to the matt pattern surfaces on both sides;

Pilkington Sunplus™ SM AR: ultra high solar energy transmittance with Anti-Reflective properties due to the application of an AR coating, designed and optimised for crystalline silicon technologies.

Pilkington Sunplus™ and **Pilkington Optiwhite™** are also ideal products for the cover plate of solar thermal collectors, as toughened, high transmittance glass is required for this application.

Thermal Insulation

Pilkington Optifloat™ Clear is our high quality float glass. It can be used in a wide variety of applications, often representing a practical and stylish alternative to solid materials. It may be used in the exterior and interior of buildings to permit the transmission of daylight and allowing occupants to view their surroundings.

Pilkington Energy Advantage™ and **Pilkington K Glass™** are on-line coated low-emissivity glass products that offer substantial improvement on thermal insulation when compared to clear float glass. They are also characterised by high solar heat gain, which means that as well as retaining heating warmth in a room, they allow high levels of solar energy to enter, for warmer and brighter interiors in sunny spells, and reduced heating and lighting costs.

Extremely versatile, they can be used in their monolithic form or in Insulating Glass Units. They are recommended for new buildings and renovations/modernisations where high solar heat gain is beneficial. They can also be manufactured on **Pilkington Optiwhite™** low iron substrate to enhance the solar heat and light transmittance.

Pilkington Optitherm™ is a range of high performance low-emissivity off-line coated glass products that offer high to very high thermal insulation performance as well as neutrality.

Pilkington Optitherm™ S3 is one of the market leading super neutral low-emissivity glasses, due to its very high light transmittance and low light reflectance. For applications requiring a U_g -value of $1.0 \text{ W/m}^2\text{K}$, we offer **Pilkington Optitherm™ S1**.

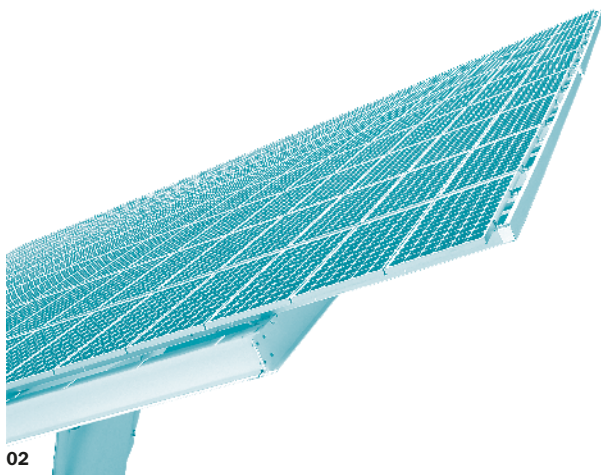
Developed specifically for energy-optimised triple glazing, **Pilkington Optitherm™ GS** maximises solar energy gain and reduces heat loss to increase the energy-efficiency of houses.

Pilkington Optitherm™ GS exceeds the criteria for Passiv Haus glazing, achieving a total solar energy transmittance (g value) of up to 63% whilst still attaining a U_g -value of as low as $0.6 \text{ W/m}^2\text{K}$.

The **Pilkington Optitherm™** range has been specially developed for use in Insulating Glass Units. The products can be enhanced when combined with other products from the Pilkington range to provide additional benefits such as self-cleaning, noise control or safety/security properties. They can be used from the smallest installation to the most prestigious curtain walling applications – anywhere where there is concern for reduced energy consumption and heat loss.

Pilkington Insulight™ Therm is the name for our own range of Insulating Glass Units for improved thermal insulation. These are technically advanced, dual seal units which comply with national and international standards as required. They can achieve a range of performance levels using our range of low-emissivity coating options listed above. In the UK, **Pilkington energiKare™** is the name given to a range of Insulating Glass Units which incorporate **Pilkington K Glass™** and benefit from improved g value to optimise performance for Window Energy Ratings (WERs) for replacement windows in homes.

Pilkington Spacia™ is the world's first commercially-available vacuum glazing. It offers the thermal performance of conventional double glazing in only the same thickness as single glass. It provides a real solution to the problems of balancing historical preservation with modern comfort and environmental requirements. **Pilkington Spacia™** has a low overall thickness as well as a good acoustic performance and is ideal for use in historic buildings, offering replacement windows more in keeping with the original design. It may even allow the use of the original frames if these are in a reasonable or repairable condition.



Fire Protection

Pilkington Pyrostop® is a clear, multi-laminated fully insulating fire-resistant safety glass that offers the highest level of fire protection, effectively blocking the transmission of conductive and radiant heat, while maximising the transmission of natural light and transparency. **Pilkington Pyrostop®** is designed for interior and exterior use where thermal insulation is required up to class EI 180. It is suitable for use with steel, aluminium and timber frames in monolithic form or Insulating Glass Units, and is ideal for use in transparent partitions, windows (special application), doors, screens and façades or for horizontal applications (roof and inclined glazing).

Pilkington Pyrodur® is a clear multi-laminated fire-resistant glass designed to provide basic integrity performance and to reduce the radiant heat transfer. It is suitable for internal and external applications up to class EW 60. **Pilkington Pyrodur®** is available for use with steel, aluminium, softwood and hardwood timber frames. It is particularly suited for use in doors, screens and partitions where lightweight, narrow profiles are important and ease of glazing is a priority. Further applications include Insulating Glass Units in façades and roof glazing (special compositions for inclined applications).

Pilkington Pyroclear® is a clear high performance monolithic basic integrity fire-resistant and safety glass. It is suitable for internal and external applications where integrity only performance is sufficient. **Pilkington Pyroclear®** has been approved in single and double glazed units for use with steel and aluminium systems. It is suited for use in doors, screens and partitions in line with national regulations as an effective barrier against fire, smoke and fumes.

Glass Systems

Pilkington Planar™ is the world's leading structural glazing systems. It uses a combination of glass and high grade stainless steel fittings, which when combined with a countersunk hole can attain a flush façade with very little distortion. There are various **Pilkington Planar™** system glass types; from single toughened, laminated, double or even triple glazing to suit every requirement.

With the flexibility to incorporate most of the vast array of Pilkington glass products, including solar control, low-e as well as **Pilkington Activ™** self-cleaning glass, **Pilkington Planar™** allows clients and architects the ability to build attractive, sustainable buildings that produce a greater feeling of light and space, thus, improving the working environments within.

The **Pilkington Planar™** system covers a large spectrum of applications and is not limited in size. The system can be utilised from small technically straightforward situations through to major building packages that are technically challenging. Past work includes curtain walling systems with opening lights, complex three dimensional façades and roofs, and curved façades.

Pilkington Profilit™ is a range of alkali cast glasses in U-shape, which are produced according to EN 572, Part 7, using the machine rolling process. The products are translucent, but not transparent, with or without a patterned surface on the outside and have the quality features of cast glass. The end result is a wall that obscures vision but allows light to pass through. **Pilkington Profilit™** products can be used in interior or exterior applications. The glasses are available in a variety of functions, colours and textures with varying translucency, allowing for the passage of natural daylight without the loss of privacy. **Pilkington Profilit™** products can offer thermal insulation, solar control, excellent sound reduction as well as safety characteristics. They provide the most cost-efficient glass walls systems available. The products come in various dimensions and shapes (e.g. **Pilkington Profilit™ Wave**), designs (e.g. **Pilkington Profilit™ Opal**), patterns (e.g. **Pilkington Profilit™ Slim Line**) and glass compositions (e.g. **Pilkington Profilit™ OW** low-iron glass). The range of products can be single, dual or triple glazed.

Noise Control

Pilkington Optiphon™ is a high quality acoustic laminated glass that offers excellent noise reduction without compromising on light transmittance or impact performance. The desired acoustic performance can be achieved through combining various thicknesses of glass with a special polyvinylbutyral (PVB) interlayer. With a large variety of product combinations, it offers the opportunity to achieve specific noise reduction requirements.

Pilkington Optiphon™ can be combined with other Pilkington products for a multi-functional noise-reduction monolithic glass or a multi-functional noise-reduction Insulating Glass Unit providing additional benefits, such as thermal insulation, solar control or self-cleaning. It is the ideal choice of glass in any buildings where there is excess noise from road, rail or air traffic, or other sources such as factories or nightclubs.



Safety/Security

Pilkington Optilam™ is our laminated glass, produced by combining two or more sheets of float glass with one or more interlayers, the most popular of which is a PVB interlayer. The interlayers ensure the integrity of the glass, by holding the broken pieces in place should any damage occur. In fact, glass fragments adhere strongly to the interlayer, while the resistant cushioning effect dissipates the energy.

Pilkington Optilam™ can be enhanced when combined with other Pilkington products to provide additional benefits such as self-cleaning, solar control or thermal insulation. We can influence the performance of **Pilkington Optilam™** simply by changing the number and thickness of each layer of glass and PVB interlayer. By doing this, we can offer a wide range of products suitable for many applications, whether it is for safety (glazed building entrances, internal doors, overhead and roof glazing, swimming pools and windows in critical risk locations), security (applications which display valuable goods, such as museums or in banks or building societies, as well as safety glazing in hospitals and prisons) or bullet resistance (high risk buildings such as banks, post offices, building societies, embassies, cash offices, military establishments and VIP residences).

Self-cleaning

Thanks to its revolutionary coating, our **Pilkington Activ™** on-line coated self-cleaning range of glasses stay cleaner, all-year round. Their unique dual-action coating uses the forces of nature to help keep the glass free from dirt, giving not only the practical benefit of less cleaning, but also clearer, better-looking windows.

The self-cleaning coating can be combined with solar control and/or thermal insulation glass in an Insulating Glass Unit for a comfortable environment all year round.

Pilkington Activ™ is available in combination with other products from the Pilkington range to provide additional benefits such as impact resistance or increased security (**Pilkington Activ Optilam™**), noise control (**Pilkington Activ Optiphon™**), solar control (**Pilkington Activ™ Blue**, **Pilkington Activ™ Neutral**, and **Pilkington Activ Suncool™**) or thermal insulation (**Pilkington Activ Optitherm™**).

Special Applications

Pilkington Optiwhite™ is an extra clear, low iron float glass with very high light transmission. It is practically colourless, and the green cast inherent to other glasses is not present. It is therefore ideal for use where glass edges are visible or where a neutral colour is desired. As its light transmission is 1% and 6% higher than clear float glass in 3 mm and 15 mm thickness respectively, it achieves greater brilliance and transparency, allowing a clear and true representation of colours when viewed through the glass. These same qualities also allow for maximum interior daylight; this is why it is the product of choice for architects for buildings where transparency and brightness are of paramount importance.

It can be combined with other products from the Pilkington range. For example, when combined with **Pilkington Suncool™** it decreases the risk of thermal breakage and reduces the need for toughening, whilst providing additional high performance solar control and low-emissivity. When used in exterior glazing, it enhances true colours and allows maximum light transmission, even in thicker laminated combinations. In domestic windows, **Pilkington Optiwhite™** maximises passive solar gain to reduce the need for heating during cold sunny days.

For more information please visit www.pilkington.com and consult your local representative about availability in your region.

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