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Energy efficiency in buildings

Today's increased use of glass in architecture and the ever-growing focus on energy efficiency are driving building developers, owners and occupants to demand higher-performing products than ever before.

Buildings are increasingly becoming the focus of energy-saving initiatives not only because they are a significant energy-consuming sector, but the technologies and products to make buildings substantially more energy-efficient have already been developed. Continuing developments in glass technology, such as low-emissivity and solar control, have revolutionised the potential of glazing applications. Improving the energy-efficiency of buildings also means that they are more comfortable and cheaper to run for the owner and occupier.

Pilkington United Kingdom Ltd as part of the NSG Group is continually developing products to help specifiers achieve reduced carbon emissions. In buildings that would traditionally be air-conditioned or use high levels of artificial lighting our solar control glass rejects unwanted solar radiation but transmits valuable daylight. Conversely, our energy saving low-emissivity glass reduces heat loss from buildings and, in some cases, our products combine both low-emissivity and solar control performance.

Advanced products from the Pilkington range enable buildings to be both energy-efficient and attractive. Glass can be used as a positive contributor to low-energy performance, whilst creating interiors that are comfortable and façades which connect the occupant with the outside world. A good choice of glass manages internal comfort by controlling direct radiation, glare, internal temperature and light levels as well as saving capital and running costs.

Solar Control

Solar control is a key issue in terms of energy saving. In hot conditions or for buildings with high internal loads, solar control glass is used to minimise solar heat gain by rejecting solar radiation and help control glare. In more temperate conditions it can be used to balance solar control with high levels of natural light.

The topic of air-conditioning is becoming a major concern to building designers and architects. More energy is used to operate air-conditioning systems during the summer months, than to heat the building in winter thereby increasing the carbon footprint. It is therefore essential to improve the energy efficiency of buildings during the summer as well as winter.

During the winter, low-emissivity glass can reduce heat loss while allowing high levels of valuable free solar gain to heat buildings with no significant loss in natural light. However, unless combined with solar control, in the summer it can become uncomfortably hot.

The correct choice of glass can help to reduce the capital outlay, running costs and associated carbon emissions of a building throughout the year.

Given the variety of building designs and climatic conditions and the different levels of exposure to solar radiation during the year, the choice of glass must be able to protect the inside of the building to ensure maximum comfort, minimise energy consumption, guarantee safety and, not least, provide the optical and aesthetic qualities that satisfy the designer.

We are continually innovating and developing products that satisfy the full range of architectural requirements. Over the years the company has developed a wide range of energy management solutions for large and small glazed areas on all types of building.

Our innovative solar control products cover the whole range:

- High performing, off-line coated, solar control and low-emissivity products within the Pilkington **Suncool™** range
- On-line coated environmental control glasses that combine good solar control performance with low-emissivity such as Pilkington **Eclipse Advantage™** and Pilkington **Solar-E™**
- Low-performance, body-tinted glass in the Pilkington **Optifloat™** Tint range
- Solar control glass combined with the revolutionary, self-cleaning Pilkington **Activ™**

In addition to the above ranges the Pilkington Solar Control range can be used with many other Pilkington solutions, to achieve countless benefits in terms of safety, functionality and cost-efficiency.

Swimming Pool, Switzerland –
Pilkington **Suncool™** 50/25



How it works – Glass controls solar heat radiation from the sun by reflectance, transmittance and absorptance. For solar control purposes these are defined in terms of the following parameters:

Reflectance – the proportion of solar radiation reflected back into the atmosphere

Direct Transmittance – the proportion of solar radiation transmitted directly through the glass

Absorptance – the proportion of solar radiation absorbed by the glass

Total Transmittance (also known as g value) – the proportion of solar radiation transmitted through the glass by all means. This is composed of the direct transmittance and that which is absorbed by the glass and re-radiated inwards.

Please note:

Solar control glass in annealed form may be subject to thermal stress and a thermal safety check is advisable for all applications.

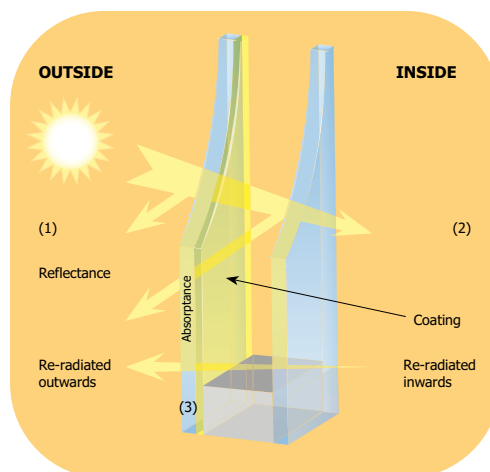
Further parameters given to glass are as follows:

Light transmittance – the proportion of the light that is transmitted by the glass

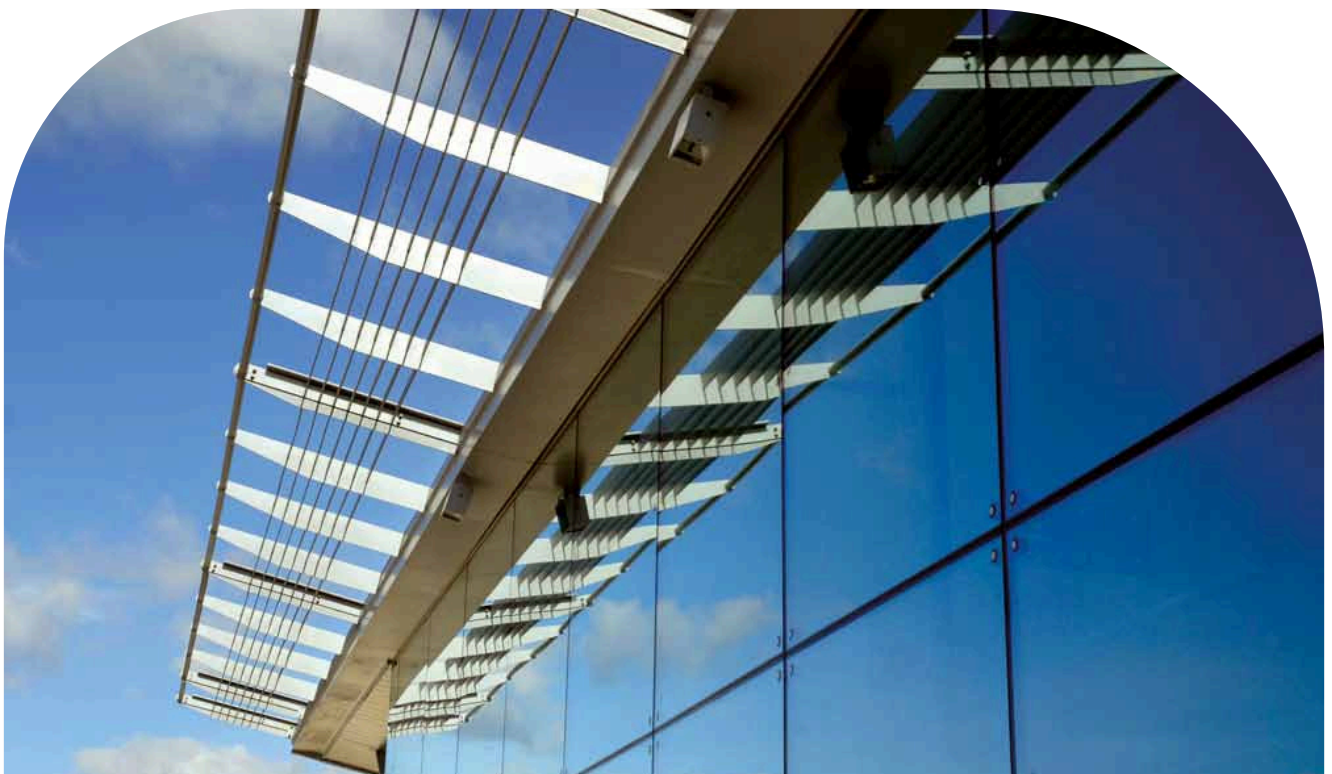
Light reflectance – the proportion of the light that is reflected by the glass

Total Shading coefficient – the ratio between total solar heat transmittance of the glass and that of a single 3 mm thick clear float glass

Selectivity index – the ratio between light transmittance and total solar heat transmittance



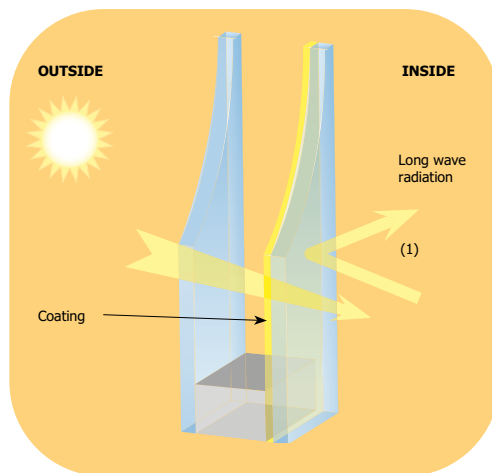
Insulating Glass Unit incorporating coated solar control glass



Low-emissivity

Advances in low-emissivity (low-e) glass technology have made windows an essential contributor to energy conservation and comfort, minimising heat loss and internal condensation. The measure of heat loss is usually expressed in terms of Ug-value, which is the rate of heat loss in Watts per square metre per degree Kelvin temperature difference between inside and outside (expressed as W/m^2K); the lower the Ug-value, the better the insulation of the product.

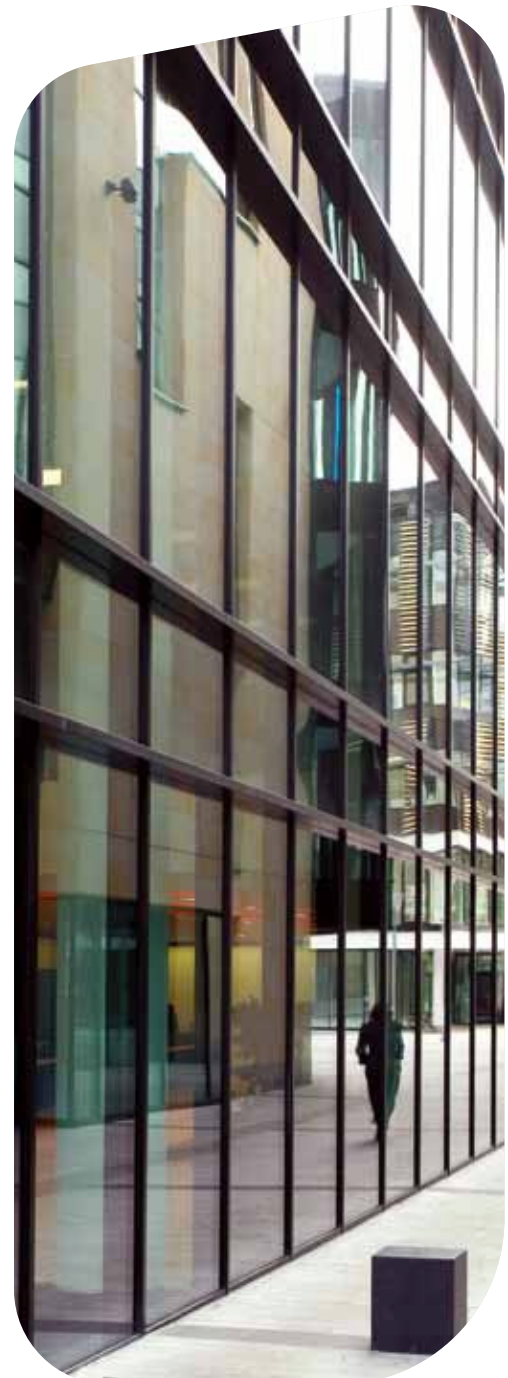
How it works – Effectively, low-emissivity glass will reflect energy back into a building, to achieve much lower heat loss than ordinary float glass. Additionally, different types of low-emissivity glass allow different amounts of passive solar heat gain which helps reduce heating requirements and costs, especially in colder months.



Solar energy enters the building mainly as short wave radiation but, once inside, it is absorbed by objects and re-radiated as long wave radiation. Low-emissivity glass has a coating that allows the transmission of the sun's short wave radiation but reflects long-wave radiation from the heaters, lights and equipment in the room, providing an effective barrier to heat loss. To maximise energy efficiency all year round, often the ideal glazing solution balances both solar control and low-emissivity performance.

Our products offer two ways in which this can be achieved:

- By applying a single product which provides both solar control and low-emissivity in an Insulating Glass Unit
- By using both a solar control product and a separate low-emissivity product within an Insulating Glass Unit



The Pilkington low-emissivity range covers all levels of performance:

- On-line products such as Pilkington **K Glass™** and Pilkington **Eclipse Advantage™**
- Low Ug-value off-line solutions in the Pilkington **Optitherm™** range
- Low-emissivity and solar control properties in a single product: Pilkington **Suncool™**; Pilkington **Eclipse Advantage™** and Pilkington **Solar-E™**

The Pilkington Spectrum software can be used to calculate the parameters of Insulating Glass Units and print technical data sheets for the specific combination. The program is extremely easy to use by simply selecting the components of the glass unit. The program automatically calculates the main parameters and displays

them in graphic form. You can register to access the online version of the program free of charge from www.pilkington.com/spectrum.

The NSG Group has a long and accomplished history in the production and specification of glass products which meet and exceed customers' requirements. Major landmark projects in nearly all countries across the globe are proof of our expertise and track-record which are continuously supported by our dedicated specialists in Research and Development, Manufacturing, Technical Advisory Service (TAS), Project Business and Customer Service teams. Our Project Business and TAS teams work in conjunction, helping to ensure that architects and specifiers find the correct product.

Cruise Liner Ferry Terminal, Liverpool – Pilkington **Suncool™** 50/25



Introduction to the Pilkington Solar Control range

There are two basic processes for coating glass known as “on-line coating” (such as Pilkington **Eclipse Advantage**[™]) and “off-line coating” (such as Pilkington **Suncool**[™]). On-line coatings are applied during manufacture of the glass whilst it is still hot, whereas off-line coatings are applied after the glass has been processed. Off-line coatings are generally able to give higher levels of selectivity, thermal insulation and light transmittance than on-line coatings but they require extra care in handling and processing. Both on-line and off-line coatings can be supplied in toughened and laminated form.

Generally, on-line coated glass offers lower levels of solar control and thermal insulation levels than off-line coated products. However, they are easier to handle and process and can be toughened or laminated directly from stock. In addition, on-line coated products such as Pilkington **Eclipse Advantage**[™] are highly durable and in certain circumstances can be single-glazed.

Scientific and Research Centre, University of Technology,
Wroclaw, Poland – Pilkington **Eclipse Advantage**[™] Blue-Green





The Light Building, Leeds – Pilkington **Suncool**™ 66/33

Pilkington **Suncool**™

Pilkington **Suncool**™ is a range of superior solar control products with a wide range of visible light transmittance, reduced solar transmittance and excellent low-emissivity all in one superb product. The excellent solar control properties of Pilkington **Suncool**™ can greatly reduce the need for air conditioning within a building, whilst its insulation properties can reduce heat loss to 1.0 W/m²K in a standard Insulating Glass Unit (6-16-6). With its extensive range, Pilkington **Suncool**™ offers the ideal choice for providing maximum light transmission and thermal comfort for occupants all year round.

Pilkington **Suncool**™ glass incorporates a thin, sputtered, metal oxide coating applied off-line. This method is used to obtain different types of coatings to offer a range of properties, increasing freedom of design and aesthetic options and ensuring efficient use of light and heat. Depending on the individual application a wide range of appearance and performance options are available.

Pilkington **Suncool**™ products are suitable for commercial and residential applications that demand high light transmission properties. They are designed to achieve optimum performance in large glazed areas and are available in a wide range of performances.

Pilkington **Suncool**™ must be incorporated in an Insulating Glass Unit with the coating on the inside surface of the outer pane. The Pilkington **Suncool**™ range of products can be used with many other Pilkington solutions, to achieve countless benefits in terms of functionality and cost-efficiency.

Pilkington **Suncool**™ products are available in annealed, toughened, laminated and sound insulation form and on Pilkington **Optiwhite**™.* In addition, Pilkington has developed a range of spandrel products for the Pilkington **Suncool**™ range to allow continuity of appearance from spandrel to vision areas of glazing.

*Pilkington **Optiwhite**™ is a low iron glass with improved light and solar transmittance properties. It can be used as the substrate for most Pilkington **Suncool**™ products or on its own to take advantage of desirable solar heat and light transmittance.



Polish-German Foundation, Warsaw, Poland – Pilkington **Optifloat™** Grey

Pilkington **Eclipse Advantage™**

Pilkington **Eclipse Advantage™** combines low-emissivity with good solar control in a unique range of colours. This type of glass offers a range of reflection properties to provide interior glare control for improved aesthetics and design flexibility. The Pilkington **Eclipse Advantage™** product range was specifically designed for use in countries with a warm climate and offers improved energy-efficiency in both summer and winter.

Pilkington **Eclipse Advantage™** is manufactured using an innovative pyrolytic process patented by Pilkington. A vapour deposition process is used to form a thin chemical coating on the surface of the ribbon of float glass.

As Pilkington **Eclipse Advantage™** has a pyrolytic coating it can be toughened or bent without any change to its properties. It can be handled, processed and incorporated into Insulating Glass Units using standard techniques. Pilkington **Eclipse Advantage™** can also be made available in a Pilkington **Optiphon™** version.

The products can also be combined within an Insulating Glass Unit with many other products within the Pilkington range for added performance.

Pilkington **Solar-E™**

Pilkington **Solar-E™** is a range of good solar control performance pyrolytic on-line coated glasses with neutral appearance, low reflectivity, reduced glare, low solar heat gain and low-emissivity properties.

Pilkington **Solar-E™** products can be used in single glazing applications provided that the coating faces the interior of the building. It can be toughened or laminated where safety glass is required.

Pilkington **Optifloat™ Tint**

Pilkington **Optifloat™ Tint** is a range of low-performance, body-tinted glasses which is manufactured using the standard float glass process. It is particularly suitable for applications that demand solar control without the use of surface coatings.

These products are available in a range of colours and thicknesses with solar control properties and colour densities that vary with thickness.

Pilkington **Optifloat™ Tint** can be handled, processed and assembled into Insulating Glass Units as normal float glass. For solar control and thermal performance, Pilkington **Optifloat™ Tint** can be combined with Pilkington low-emissivity glass in an Insulating Glass Unit.



Aysberg Business Centre, Kiev, Ukraine – Pilkington **Eclipse Advantage™** Bronze



Plymouth University, Plymouth –
 Pilkington **Suncool**™ 50/25

Pilkington **Activ**™ Range

Pilkington **Activ**™ is the world's first self-cleaning glass. Its unique dual-action coating uses the forces of nature to help keep the glass clear of organic dirt, giving you not only the practical benefit of less cleaning, but also clearer, better-looking windows. It works in two ways: first it uses daylight to break down organic dirt (such as bird droppings) and then it uses rain to wash any loosened dirt away.

Pilkington **Activ**™ also dries off faster leaving the glass cleaner and with reduced streaks, which gives you beautifully clear views and makes it ideal for various applications, from building façades to conservatory windows.

Pilkington **Activ**™ is an on-line coated product and therefore can be toughened, processed and handled using standard techniques.

The Pilkington **Activ**™ Solar Control range comprises Pilkington **Activ**™ Blue, Pilkington **Activ**™ Neutral and Pilkington **Activ Suncool**™ and combines the benefits of self-cleaning with varying degrees of solar control performance, offering the ultimate range of solar control solutions for hard-to-reach places that are difficult to clean. Often overhead glazing is subject to high levels of solar gain and is difficult to access for cleaning. Pilkington **Activ**™ with solar control provides the ideal combination for dealing with these areas.



Airiston Lumous Villa, Airisto, Parainen, Finland –
 Pilkington **Activ Suncool**™ 70/40

This publication provides only a general description of the products. Further, more detailed, information may be obtained from your local supplier of Pilkington products. It is the responsibility of the user to ensure that the use of these products is appropriate for any particular application and that such use complies with all relevant legislation, standards, codes of practice and other requirements. To the fullest extent permitted by applicable laws, Nippon Sheet Glass Co. Ltd. and its subsidiary companies disclaim all liability for any error in or omission from this publication and for all consequences of relying on it.



CE marking confirms that a product complies with its relevant harmonised European Norm.
The CE marking label for each product, including declared values, can be found at www.pilkington.com/CE