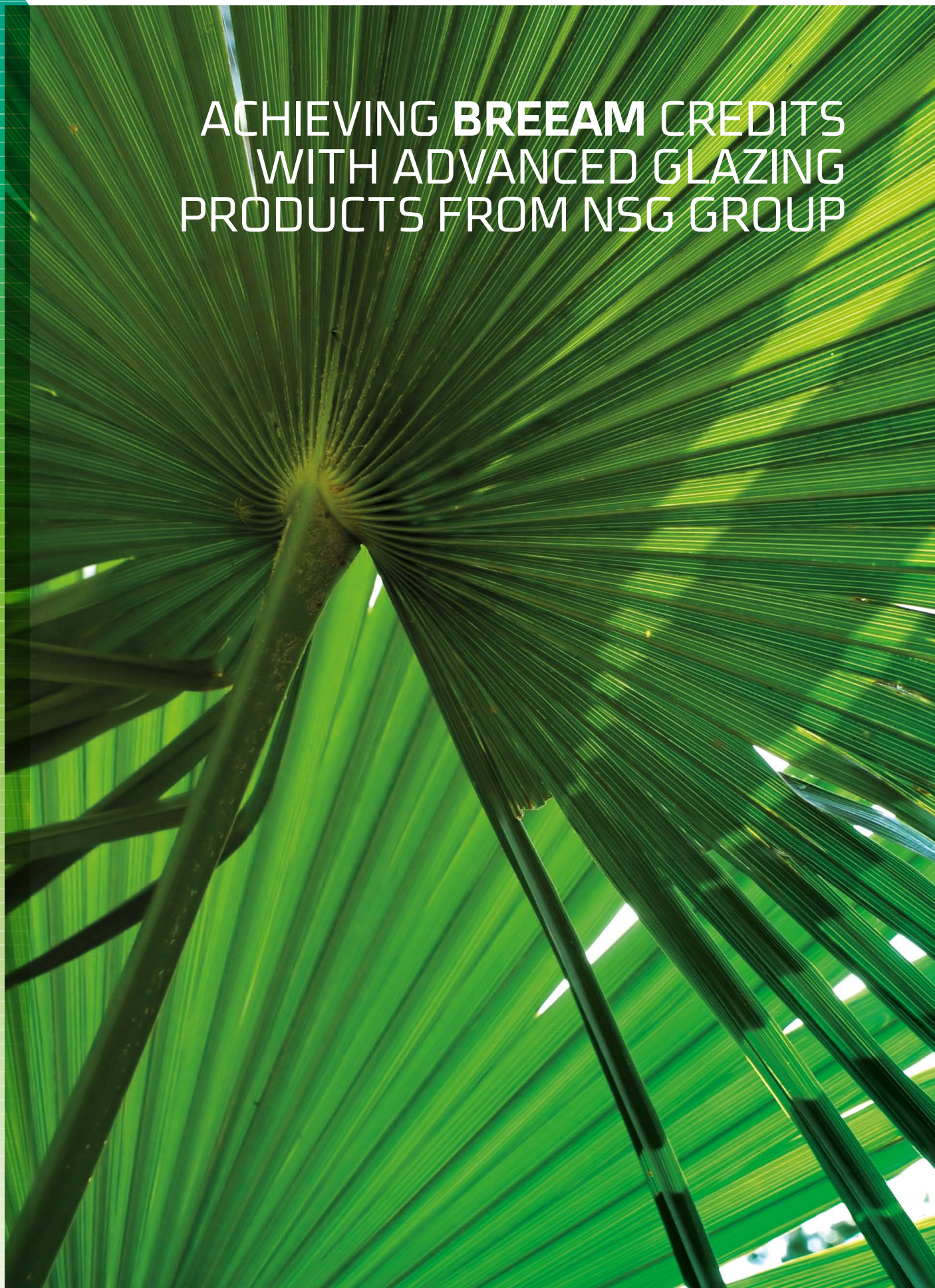
NSG GROUP

ACHIEVING **BREEAM** CREDITS WITH ADVANCED GLAZING PRODUCTS FROM 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 CO_2 Emissions

Aim: To recognise and encourage buildings that are designed to minimise the CO_2 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/m²K, 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/m²K 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/m²K (Pilkington **Optitherm™** S1) when used in a standard double IGU and 0.6 W/m²K (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/m²K 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/m²K 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/m²K 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 CO_2 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. The products range from 30 up to 71% light transmittance whilst achieving U_g-values down to 1.0 W/m²K, 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 glasses with low-emissivity properties too. They can achieve g values ranging down to 28% and U_g-values of 1.5 W/m²K 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™**, Pilkington **SunShade™** Silver, Pilkington **Reflite™** and high performance tinted glasses such as Pilkington **Arctic Blue™** are medium performance 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 products 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.

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 CATEGORY

Materials Specification

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

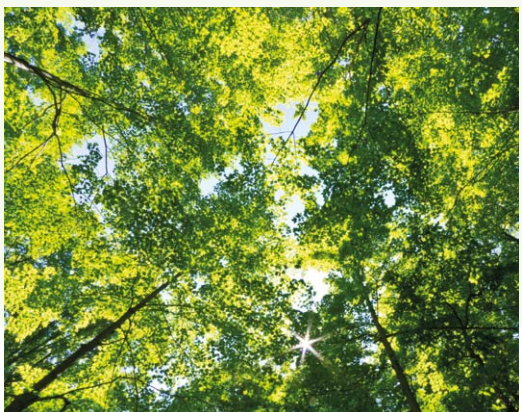
Aim: To recognise and encourage the specification of responsibly sourced materials for key finishing elements (includes windows).

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 & 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 Ug-value as stated earlier (see also Energy Category – Reduction of CO_2 Emissions).

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 Rw 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.breeam.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.

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