



PILKINGTON



Glass Laminating Solutions

New **Planar™** | SentryGlas® Plus System

The world's leading forces in structural glass systems and laminate interlayers have joined together to create the ultimate in strength, safety, durability and appearance in laminated structural glass – the **Planar™** | SentryGlas® Plus System.

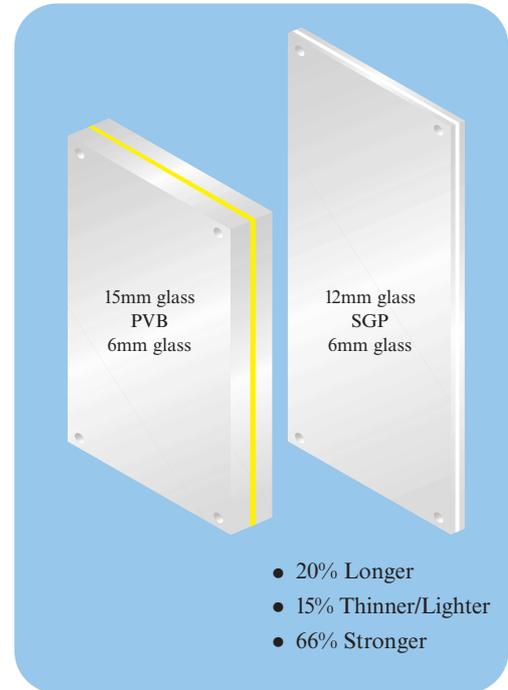


Planar™ | SentryGlas® Plus System installation allowing exposed edges: Alvarado Medical Centre, California

Pilkington has been at the forefront of frameless glazing technology for more than 30 years, and Pilkington **Planar™** is the most tested and most trusted structural glass system, chosen by architects and engineers for their most challenging applications. Now Pilkington engineers working with DuPont™ scientists have combined their leading edge technologies to develop the **Planar™** | SentryGlas® Plus System: the latest advance in frameless glazing.

Applications of the **Planar™** | SentryGlas® Plus System are not just confined to complex projects. Significant benefits can be realised on any project in which increased strength or enhanced appearance are considered to be of importance. The versatility of the **Planar™** | SentryGlas® Plus System can now match the demands of projects on all levels.

Performance comparison of Pilkington **Planar™** using SentryGlas® Plus (SGP) versus PVB interlayers*



*Based on Test Data

Benefits

Stronger

The laminated glass in the **Planar™** | SentryGlas® Plus System is substantially stronger than traditional PVB laminated systems. Therefore, while the system still offers the same high levels of performance synonymous with Pilkington **Planar™**, it can be made with a thinner glass.

Lighter

The use of custom-designed Pilkington **Planar™** fittings in combination with stronger laminated glass panels results in a **Planar™** | SentryGlas® Plus System typically being much lighter than its more conventional PVB counterpart. This can result in longer panels, a reduced number of support fixings and lighter weight support structures-reducing their visual impact, as well as providing cost savings.

More Durable

SentryGlas® Plus is manufactured by DuPont™, the leader in glass interlayers, and has been subjected to intensive testing to ensure its long term stability.



Above: Laminated Structural Glazing Canopy installation: 55 Water Street, New York, Harmin Jablin Architects

Front cover shot: **Planar™** | SentryGlas® Plus System overhead glazing installation: Yorkdale Shopping Centre, Toronto

Safer

Tests have proven that the **Planar™** | SentryGlas® Plus System has residual strength, even with both glass components broken (*see Graph 1, page 6*). This brings greater peace of mind in locations subject to typhoons or hurricanes, and makes it possible to specify laminated glass for canopies and skylights which can be accessed for maintenance.†

The **Planar™** | SentryGlas® Plus System can also be designed to withstand a variety of bomb blast performance requirements.

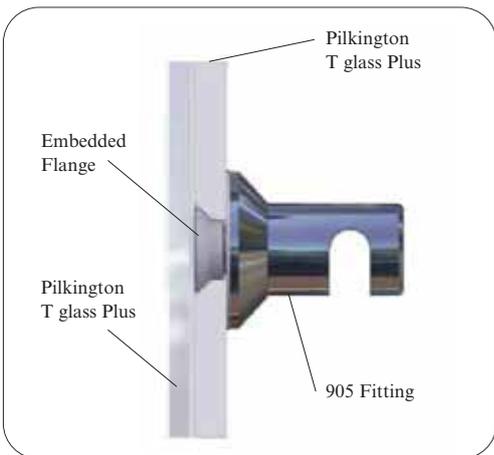
† Subject to local regulations and safe working practices



Planar™ | SentryGlas® Plus System Panels undergoing load testing

More Applications

The **Planar™** | SentryGlas® Plus System can be supplied using the revolutionary Pilkington **Planar™** Integral System, allowing a much wider choice of glass than traditional structural laminates.



Detail of Pilkington **Planar™** Integral

Maximum Clarity

The SentryGlas® Plus structural interlayer is significantly clearer than traditional interlayers. When used with Pilkington **Optiwhite™** exceptional clarity is achieved, even in a laminated glass.



Exceptional clarity

Installation

Installed only by a worldwide network of trained and accredited contractors, the **Planar™** | SentryGlas® Plus System provides the user and specifier with absolute peace of mind throughout the construction process.

12 year warranty

The **Planar™** | SentryGlas® Plus System is subject to a design and engineering check by Pilkington engineers, and carries the full Pilkington **Planar™** 12 year warranty.



The William Jefferson Clinton Presidential Centre & Library, Little Rock, USA

Planar™ | SentryGlas® Plus System in action



Project: Yorkdale Shopping Centre

Location: Toronto, Canada

Architect: MMC International

Specification: Planar™ | SentryGlas® Plus System

Insulating Glass Units comprising:

10mm Pilkington **Suncool™** HP Clear 65/41
T Plus outer glass

16mm Gas Filled Cavity (argon)

17.52mm Inner laminated glass comprising of:

10mm Pilkington **Optifloat™** T Plus

1.52 SentryGlas® Plus Structural Interlayer

6mm Pilkington **Optifloat™** T Plus
with Silk Screen Printing.

Scope: The addition of a 60 foot high, 300 foot long barrel-vaulted atrium to the centre originally built in 1964.

The structural glass roof uses open space and natural light to create the streetscape feeling that the architects wanted.

Project: Mission Valley East LRT – Alvarado
Medical Centre

Location: San Diego, CA. USA

Architect: Parsons Brinkerhoff, Los Angeles,
CA. USA

Specification: Planar™ | SentryGlas® Plus System

10mm Pilkington **Optifloat™** Green T Plus

1.52mm SentryGlas® Plus Structural Interlayer

6mm Pilkington **Optifloat™** T Plus
with Pilkington **Planar™** seismic 905 fittings.

Scope: 6 canopies totalling 2500sq.ft. Steel tube structure with gusset plates to support the seismic fittings.



Project: The William Jefferson Clinton Presidential Centre & Library

Location: Little Rock, AR. USA

Architect: Polshek Partnership Architects, LLP

Specification: Planar™ | SentryGlas® Plus System

10mm Pilkington **Optiwhite™** T Plus

SentryGlas® Plus Structural Interlayer

10mm Pilkington **Optiwhite™** T Plus.

Scope: Approximately 13,000 sq.ft of Pilkington **Planar™** laminated glass, incorporating Pilkington **Optiwhite™** low-iron glass.

The project underwent a severe testing regime, surviving loading to 160PSF (8kPa).

Unless otherwise stated, all Pilkington **Planar™** was supplied by W&W Glass Systems Inc. New York, USA



Project: Hong Kong Police Headquarters

Location: Arsenal Street, Wanchai, Hong Kong

Architect: Hong Kong Architectural Services Department

Specification: Planar™ | SentryGlas® Plus System

8mm Pilkington **Optifloat™** T Plus

1.52mm SentryGlas® Plus Structural Interlayer

19mm Pilkington **Optifloat™** T Plus with Pilkington **Planar™** Integral fittings

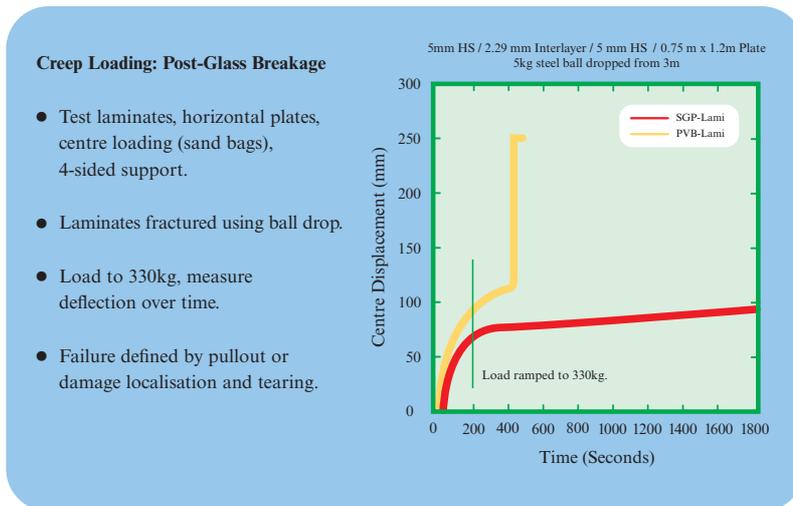
Glazing Contractor: S M Engineering Ltd. Hong Kong

Scope: Over 12,000 sq.ft of the **Planar™** | SentryGlas® Plus System is used in this installation.

Designed to give maximum protection against typhoon wind loads (4kPa or 200mph) and other threats.

What makes the Planar™ | SentryGlas® Plus System so efficient?

Graph 1: Residual Strength – even with both glass components broken



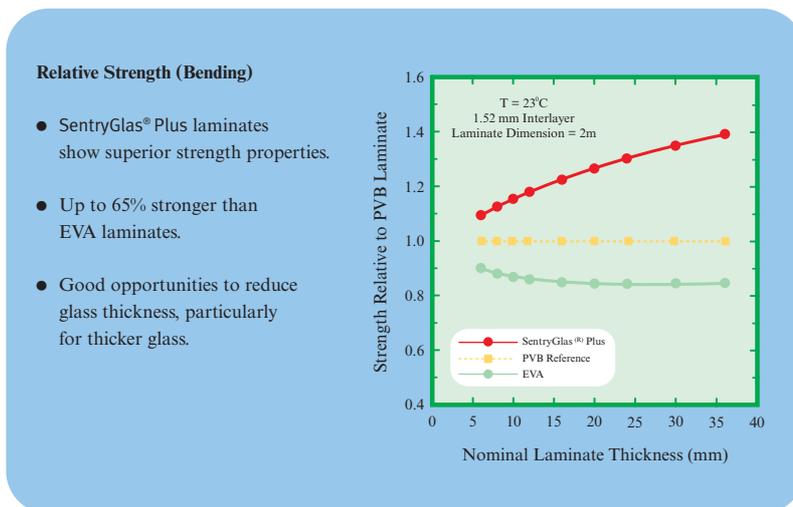
Glass

Pilkington toughened glass is manufactured to exceedingly high quality specifications, including increased toughening stress while maintaining very low distortion – often a contributing factor to problems associated with laminated glass.

Load sharing

Specially developed Pilkington **Planar™** fittings combined with the much higher modulus of the structural interlayer (compared with traditional interlayers – see Graph 2), allows the **Planar™** | SentryGlas® Plus System to share applied loads between both glass panels of the laminate. The fittings are designed to interlock with the interlayer to develop maximum strength and structural efficiency, giving a significant increase in load bearing capacity while at the same time reducing the thickness required.

Graph 2: Load Shared between both panels of the laminate



Low deflection

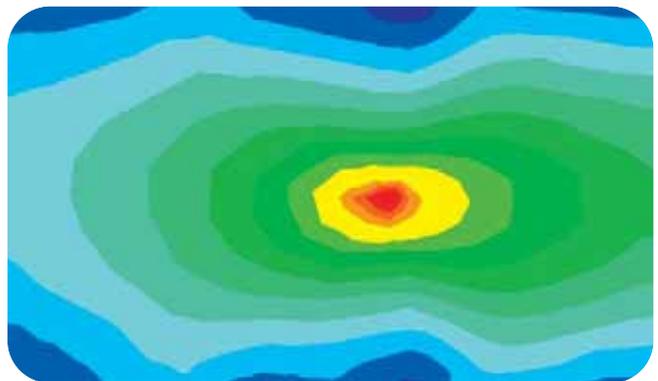
The **Planar™** | SentryGlas® Plus System fully utilises the increased stiffness of the SentryGlas® Plus interlayer (100 times that of PVB) to reduce deflections under wind and dead loads – often a limiting factor when designing structural glazing installations.

High & low temperatures

SentryGlas® Plus has a higher Glass Transition temperature (T_g) than other interlayers which means enhanced mechanical properties can be utilised over a much greater range of temperatures. Pilkington engineers allow for temperature variations and all load combinations when designing **Planar™** | SentryGlas® Plus system installations, using techniques developed by DuPont™ and Pilkington as well as international standards.



Strain Gauge Testing around Pilkington **Planar™** countersunk hole.



Analysis of **Planar™** | SentryGlas® Plus System using Finite Element Analysis.

Table 1: DuPont™ SentryGlas® Plus Edge Stability Test Data after seven years' exposure

Durability

SentryGlas® Plus is a DuPont™ engineered polymer containing no plasticisers, resulting in unrivalled edge stability. Edge Stability Numbers (ESN) with SentryGlas® Plus interlayers remain zero at all known installations, including seven year test panels exposed to severe Florida heat and humidity (see Table 1). Pilkington and DuPont™ together with the sealant suppliers have also tested for compatibility and approved a wide range of weather seals for use in the **Planar™** | SentryGlas® Plus System.

| Sample ID | Laminate Perimeter (mm) | Defect Length (mm) | | | | | ESN |
|-----------|-------------------------|--------------------|-----------|-----------|-----------|-------|-----|
| | | <1.6 | 1.6 - 3.1 | 3.2 - 4.6 | 4.7 - 6.3 | > 6.4 | |
| 1 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | 3912 | 0 | 0 | 0 | 0 | 0 | 0 |

Edge Stability Numbers (ESN) with SentryGlas® Plus interlayers remain zero at all known installations.



Seismic fittings in the **Planar™** | SentryGlas® Plus System installation: Alvarado Medical Centre, California

Design

To gain maximum benefit from the enhanced properties of the toughened laminated glass, Pilkington engineers have developed customised fittings incorporating advanced Engineering Plastic technology, and connections back to structure. These have had to be upgraded from standard Pilkington **Planar™** fittings to provide a number of functions including developing maximum strength while eliminating compression in the interlayer – which can reduce load bearing capacity and durability. The fittings are also designed to retain the laminated panel in position, even in the event of glass breakage.



Planar™ | SentryGlas® Plus System panels on test in Florida.

Planar™ | SentryGlas® Plus System specification

Planar™ | SentryGlas® Plus System glass construction

Pane 1 10, 12, 15 or 19mm Pilkington T glass Plus (Toughened and Heat Soaked)
1.52 or 2.28mm SentryGlas® Plus Structural Interlayer

Pane 2 6, 8, 10, 12, 15 or 19mm Pilkington T glass Plus (Toughened and Heat Soaked)

Glass size – rectangles

Maximum: 2000 x 3500mm -0 +4mm (larger sizes available Autumn 2005)

Minimum: 360 x 900mm -0 +4mm

Aspect ratio: 10:1 Maximum

The **Planar™** | SentryGlas® Plus System is also available using the Pilkington **Planar™** Integral design, and in Pilkington **Planar™** Insulating Glass Units (IGUs).

Standard and custom screen print patterns and tinted glass range available on request.

Each project is subject to design, engineering and feasibility checks once full and final details/drawings are supplied. For initial advice and enquiries such as larger size availability, please contact your local approved installer.



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