

# LC SmartGlass™ SPD SmartGlass™

## Electronically Switchable Glass Handbook



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We hope that you find this document useful and welcome any feedback.

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# COMPANY

<b>FOUNDED:</b>	2003
<b>DIRECTORS:</b>	John Browne (Managing), Bob Hudson (Technical), Kevin Root (Commercial), Frank Bagnall (Operations) & Richard Blake (Chairman)
<b>MANAGERS:</b>	Martin Potter (Intl Sales) Alan Saxby (Sales) & Paul Murphy (Production)
<b>SELLING AGENT:</b>	SCHOTT Glass (Worldwide) <a href="http://www.schott.com">www.schott.com</a>
<b>AUDITORS:</b>	O’Gorman Brannigan Purthill & Co.
<b>LOCATIONS:</b>	Ireland and United Kingdom & Worldwide sales offices.
<b>BUSINESS:</b>	Design, manufacture, sale and installation of LC SmartGlass™ & SPD SmartGlass™.
<b>MAJOR PRODUCTS:</b>	LC SmartGlass™ - Switchable Privacy Glass SPD SmartGlass™ - Light control Glass SLC SmartGlass – Privacy & Light control Ad Glass Speciality Glass Laminates
<b>INVESTMENT:</b>	In excess of €3 million
<b>R&amp;D Partners:</b>	Enterprise Ireland, Dublin Institute of Technology & Cambridge university faculty of engineering.
<b>IN THE PRESS:</b>	ITV Day break, Top Gear Live, Sunday Times, Channel 4 Grand Designs, About the House, Room to Improve, FT Weekend, Irish Times, RIBA Journal, Plan, Glass on web & Scientific American
<b>AWARDS:</b>	RIBA 100% Detail Innovative product of the show award 2008 & 2006. Plan Expo Product Best Innovation of the show award 2004



**Welcome** to SmartGlass International Ltd, the leading worldwide manufacturer of electronically switchable glass supplied to the commercial, hospitality, healthcare, transport and security and industrial sectors.

## Vision and Values

Our vision is to create, challenge, evolve and respect through excellence, passion, quality, innovation and drive. Our no-compromise attitude to quality and customer focus is the foundation for our commitment to creating products and experiences of real and lasting value.

Intelligent technology, advanced features, innovative solutions and quality are what set us apart.

- LC SmartGlass™ - Privacy on demand – Internal partition screens, windows, security screens & doors
- SPD SmartGlass™ - Solar Control – Windows & Roof-lights

## About SmartGlass International

SmartGlass International (SGI) is the dedicated manufacturer of Electronically Switchable Glass. Also known as privacy glass, switchable glass, intelligent glass and electric glass these technologically advanced glass products are fast breaking from being niche to becoming mainstream for use particularly in the commercial, retail, security, transport, healthcare and hospitality sectors. Our main products are LC SmartGlass™ offering Privacy on demand and SPD SmartGlass™ offering Solar-Control.

SmartGlass International has its head quarters, manufacturing, finance and R&D centres in Dublin, Ireland with commercial, sales and technical offices in the UK. With the intention of concentrating our products and markets we only produce electronically switchable glass products and through continued research and development initiatives are expanding our range of products to meet the needs of growing specialist markets in architecture, transport and medical fields. We have invested heavily in plant and machinery and have the capacity to fulfil large orders on short lead times. Each piece of SmartGlass is bespoke made to meet and exceed our client's needs, always with the client in mind.

We are an award winning company claiming such accolades as the RIBS (Royal Institute of British Architects) sponsored 100% Detail most innovative building product award.

In January 2009, SmartGlass International Ltd and SCHOTT Glass signed an agreement giving SCHOTT the Worldwide sales exclusivity for LC SmartGlass (except UK & Irl). This partnership allows both of our companies to use our particular areas of expertise to grow the Worldwide SmartGlass market.

For over 125 years, SCHOTT has been setting the standard in the special glass industry and in 2009 celebrated its 125<sup>th</sup> birthday. [www.schott.com](http://www.schott.com)

The use of intelligent smart glass provides added value and increased flexibility in new building design, improves working environments and building ergonomics, saves energy, and increases the well being of occupants. We are dedicated to bringing environmentally friendly building products and unique design capabilities to our customers.

Through continued investment we have expanded to become World leader in the manufacture of electronically controlled smart glass products for the architectural market. We offer unique and bespoke services including technical, consultancy, design, installation, supply only service, control systems, service and maintenance through to complete design & build turnkey solutions.

Employees are part of a community that strives for the highest levels in everything it does. Our no compromise attitude to quality is the foundation for our commitment to creating products and experiences of real and lasting

value. The principles of these sentiments are enthusiasm, pride and passion for our company, our products and our roots. This spirit permeates all areas of the SmartGlass International organisation and provides the backing for the full scope of our operations.

LC SmartGlass™ is used for privacy purposes allowing instant privacy at the flick of a switch. Using a minute electrical current, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa. LC SmartGlass is easily installed and uses a minute electrical current. Various configurations can be supplied including colour tinted, fire rated, double glazed, curved and shaped.

SPD-SmartGlass™ can be manually or automatically “tuned” to precisely control the amount of light, glare and heat passing through. Glass facades using patented SPD light-control technology reduce the need for air conditioning during the summer months and heating during winter. SPD SmartGlass windows give the ability to instantly switch a window to maximize daylight when it’s really needed and to provide controllable solar shading during peak light conditions is unique.

Our products foster innovative design opportunities never before available while offering unprecedented environmental benefits and protection to building inhabitants and contents.

SmartGlass is currently used in partition screens, windows, roof-lights and doors, projection screens, security & teller screens but as architects and designers explore the boundaries and turn conventional perspectives of glass on their head it is expected that the markets will continue to grow and expand into new and innovative uses.

Evidence that the trend for increases in SmartGlass sales is visible in the range and locations of projects recently completed by SmartGlass International including the Rolls Royce engines, Kempinski hotels, Guinness Storehouse, Siemens, Golbach Kirchner, Top Gear live, ITV Daybreak, Royal College of Physicians, Aramco, various hospitals, Chevron Texaco HQ, Rolls Royce marine, Damico tankers, Royal Institution of GB, Emirates Airlines, Saudi Arabian National Guard, European Space Agency, Central Bank of Ireland, Tullow Oil, Chubb Custodial, SMI, Fairline boats, Zain Bahrain, Zeus Packaging & Pictet Bank. Since 2008, our products have been sold into more than 41 countries throughout the World.

## Why SmartGlass International?

We have successfully worked with and supplied to prestigious clients, World renowned architects and landmark projects throughout the World and have built an enviable reputation for:

- **Quality Products.** Our products are designed to be not only aesthetically pleasing but also essentially functional and easy to use. The expectations raised by a strikingly individual appearance must be completely fulfilled in terms of high quality performance in all areas when the SmartGlass system is used. Excellence in providing the consumer with the highest pleasure in both ownership and use rests on the highest quality standards employed through the design and manufacturing processes.
- **Innovation.** Through extensive investment in research and development SmartGlass International continually pushes the boundaries to bring new and innovative products to its customers.
- **Design.** Our design team will work with the client, their architects and design teams in order to guarantee the products supplied are fit for purpose and are optimally designed in terms of quality, regulatory compliance, safety, aesthetics and function.
- **Customer Focus.** We strive to offer our customer a level of service that matches the unprecedented focus on quality and finish of our products. Following design, delivery and installation of your purchase the SmartGlass International product and service guarantee ensures that service and support is always close at hand. Taking care of you and your products is our main ambition. Should you need support for your products, we will do our utmost to help you as quickly and efficiently as possible.
- **Flexibility.** We strive to be as flexible as possible in order to understand and enhance the customer experience. Frequently competitors cannot supply certain configurations which SmartGlass International will supply to exceed the clients requirements.
- **Beware of cheap imitations.** Our SmartGlass products set the standards.
- **Lead time.** Through in house control of the manufacturing and quality processes, lead times generally range from 3 to 6 weeks from receipt of order. Our goal is to deliver a quality product on time.
- **International Sales Network.** Through partnership with SCHOTT glass, we can service the requirements of a worldwide customer base.
- **Environmental Policy.** We work continuously to minimise the effects of greenhouse emissions on the environment. Equal priority is given to finding a balance between the needs of the environment and the consideration given to our products qualities, economic value, aesthetic value and life span. Our products ultimately reduce green house emissions by enabling users to reduce peak electrical demands on lighting and cooling. Our production processes are carried out in a sympathetic manner always with a view to maximising recycling and minimising energy consumption and waste.



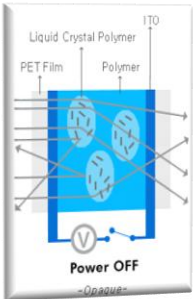
# LC SmartGlass - Privacy on Demand

## OVERVIEW

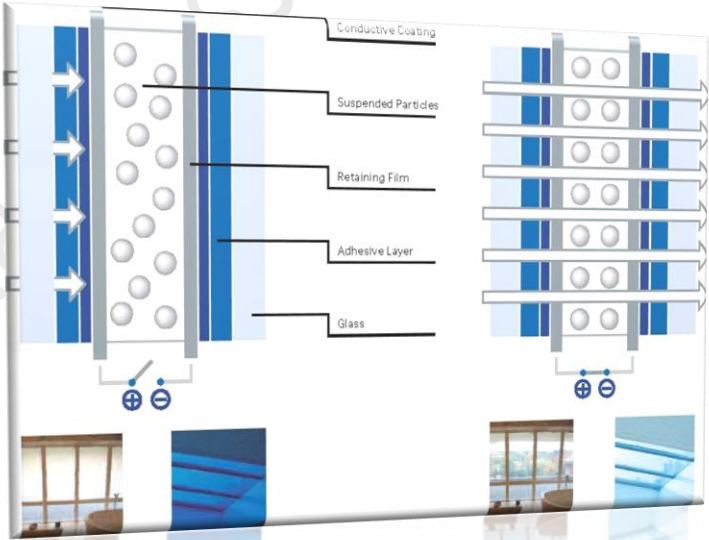
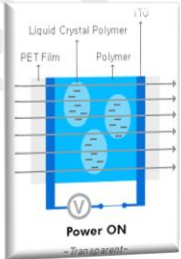
LC SmartGlass™ offers instant privacy at the flick of a switch. All LC SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a PDLC film between 2 or more glass sheets. Using a minute electrical current, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa. LC SmartGlass is easily installed and can be utilised in many applications. Various configurations can be supplied including colour tinted, fire rated, double glazed, curved and shaped.

## PRINCIPLE

When the electrical supply is switched **on**, the liquid crystal molecules align and incident light passes through and the LC SmartGlass panel instantly clears.



When the power is switched **off** the liquid crystal molecules are randomly oriented scattering light and the LC SmartGlass becomes opaque (private).



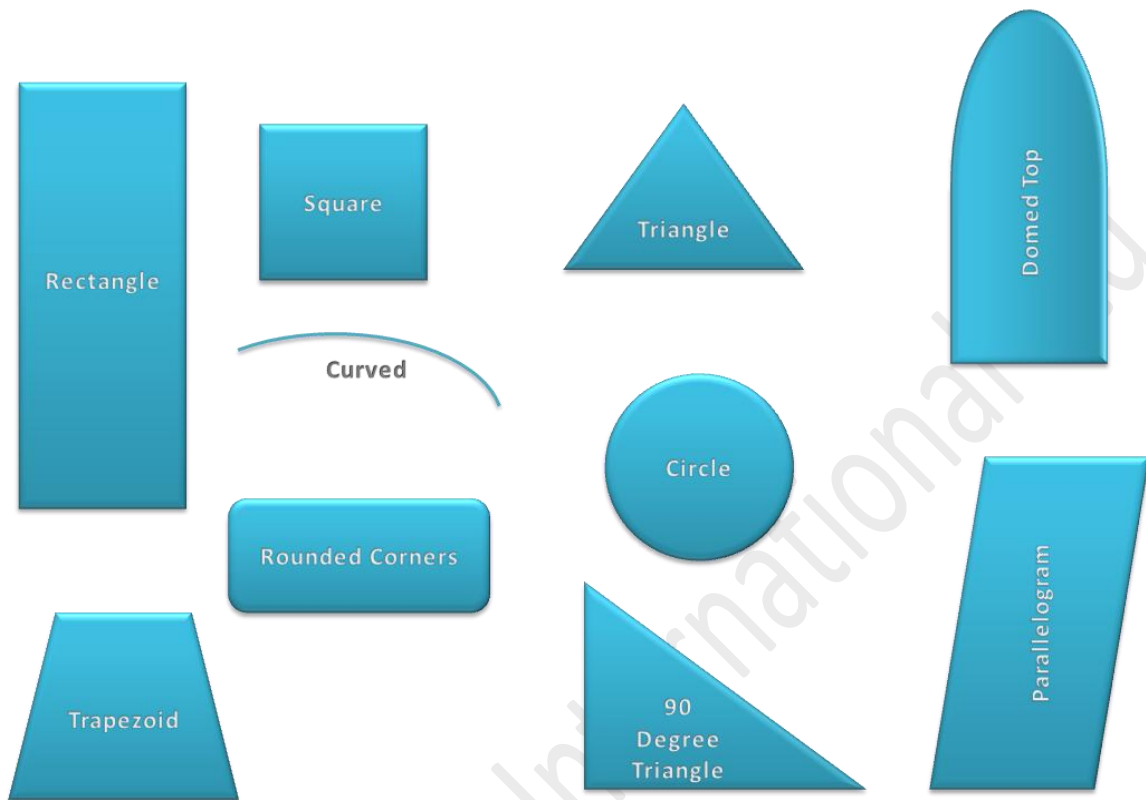
## APPLICATIONS AND FEATURES

- **Hospitality** – Hotel room privacy screen, bathroom / bedroom privacy screen, external windows, doors, conference centre windows & roof-lights, bar & restaurant screens, toilet cubicles, balustrades and balconies.
- **Commercial** – Office & boardroom partition screens, doors, sliding/folding doors, windows, roof-lights.
- **Healthcare** – Sheer easily cleaned surfaces that allow patient privacy and dignity at the flick of a switch. Fire rated hospital doors, moveable privacy screens, and X-Ray protection screens.
- **Security** – Cell doors and windows, vision panels, entrance foyer, teller & cash counting screens. Also can be incorporated into bullet proof glass.
- **Industrial** – Machinery screening, roof-lights, doors, components.
- **Rail** – Driver privacy & security screens.
- **Retail & Showroom** – Projection windows, vanity screens, feature screens.
- **Projection** – Internal or External high resolution rear projection screens.

## ADVANTAGES & BENEFITS

- Instant and precise privacy control
- Efficient use of space in the built environment
- Blocks 99.5+% of damaging UV rays
- Eco friendly
- Exceptional optical qualities that reduce glare and eye strain
- High durability, solid-state technology with no moving parts to wear out or break
- Large sizes of many shapes can be produced
- Stable colour characteristics for the life of the unit
- Aesthetically pleasing, hygienic & low maintenance
- Reduce uncomfortable “Gold fish bowl” feeling when working in high-density office buildings
- Reduced fading of carpets, furniture and protects valuable artwork
- High UV stability
- High contrast for use as rear projection screen
- Long life - tested to in excess of 1,000,000 cycles

## SHAPES



## OPERATION

LC SmartGlass is operated by applying 65V AC or 110V AC to the glass from a power transformer supplied. When a current is applied to the glass it immediately turns from opaque to clear allowing vision through. When the current is removed the glass returns to the frosted "private" state. LC SmartGlass can be operated by wall switch, radio remote, PIR switch, Crestron, ABX and more...

## CONTROLS

- Crestron, ABX, BMS, Wall switch, Remote control, Movement sensor, Timer, Door lock, etc....

## DURABILITY

Test No.	Test Item	Test Conditions	Result
		On(1sec) Off(1sec),	
1	Switching	110Vac 60 Hz 1 Million Times	Passed
2	High Temperature (Boil test)	70°C / 2 Hours	Passed
3	High Temp. / Humidity	50°C / 95%RH, 14 Days	Passed
4	Low Temperature	-20°C / 21Days	Passed
5	Heat Cycle	-20°C to 70°C (1Hrs/Cycle), 5,000Cycles	Passed
6	Weathering	Standard (For Laminated Glass)	Passed
7	Heat Resistance	Standard (For Laminated Glass)	Passed
8	Water submersed	21 Days	Passed

Product samples used

10.8mm LC SmartGlass - Mfg 16/09/08 Batch 2242A

Check on Chemical resistance acc. DIN EN ISO Task 12543-4

# LC SmartGlass CONFIGURATION

(For non-standard configurations please contact us to discuss)

<b>GLASS COLOR:</b>	Clear, bronze, grey, green, blue tint.
<b>GLASS TYPE (All laminated):</b>	Annealed (Standard), Low Iron, heat/chemical strengthened, tempered, Fire rated, curved, bullet resistant, tinted, mirrored.
<b>THICKNESS:</b>	Interior 9.5 mm, 11.5 mm, 13.5 mm or 15.5 mm Door 11.5 mm or 13.5 mm tempered Exterior Flexible: Ex. 28 mm insulating glass unit (IGU) 4 mm Low-E outer glass + 12 mm airspace + 11.5 mm LC SmartGlass™ panel
<b>SIZE:</b>	Standard - up to 1,500 mm x 3,200 mm Special sizes above the standard can be produced to client requirements.
<b>RATIO:</b>	Maximum Ratio Width: Height approx 4:1 (Without applying bus bars top and bottom or on 2 opposing sides)
<b>WIRING:</b>	Double insulated 0.5 mm <sup>2</sup> two core flex standard 4 meter, longer wires can be supplied upon request.
<b>SHAPE:</b>	Many shapes and curved including drilled holes
<b>ENVIRONMENTAL:</b>	Storage / Operation -20°C to 70°C
<b>SIZE TOLLERENCE:</b>	± 3 mm on OA size and ± 0.5 mm on thickness
<b>BOWING TOLLERENCE:</b>	± 3 mm per linear meter
<b>ELECTRICAL:</b>	Driving voltage 65VAC or 110 VAC Current less than 200 mA/m <sup>2</sup> Power approx. 5 watt/m <sup>2</sup>
<b>SWITCHING TIME:</b>	Approx. 1/100 second at room temperature
<b>OPTICAL:</b>	Transmission approx. 75% View angle approx. 120° Scattering effectiveness approx. 100 mm
<b>LIFE:</b>	Greater than 10 years
<b>WARRANTY:</b>	5 years

## LC SmartGlass Sound Control Data\*

LC SmartGlass Thickness	Configuration	DB Rating
9.2 mm	4 mm / 1.2 / 4 mm	35
11.2 mm	5 mm / 1.2 / 5 mm	37
13.2 mm	6 mm / 1.2 / 6 mm	39
25.2 mm	12 mm / 1.2 / 12 mm	44

\*Values are nominal (+/- 5%) and are dependent on glass configuration used. The above figures are recommended for guide purposes only.

## LC SmartGlass Optical performance\*

	LC SmartGlass (10.8mm) Power ON	LC SmartGlass (10.8mm) Power OFF	Clear Float Glass (6mm)	Frosted Glass (6mm)
Visible Light Transmission	75%	67%	86%	76%
Clarity	76%	4%	83%	18%
UV Transmission	0.5%	0.5%	55%	55%

\*Values are nominal (+/- 5%) and are dependent on glass configuration used. The above figures are recommended for guide purposes only.

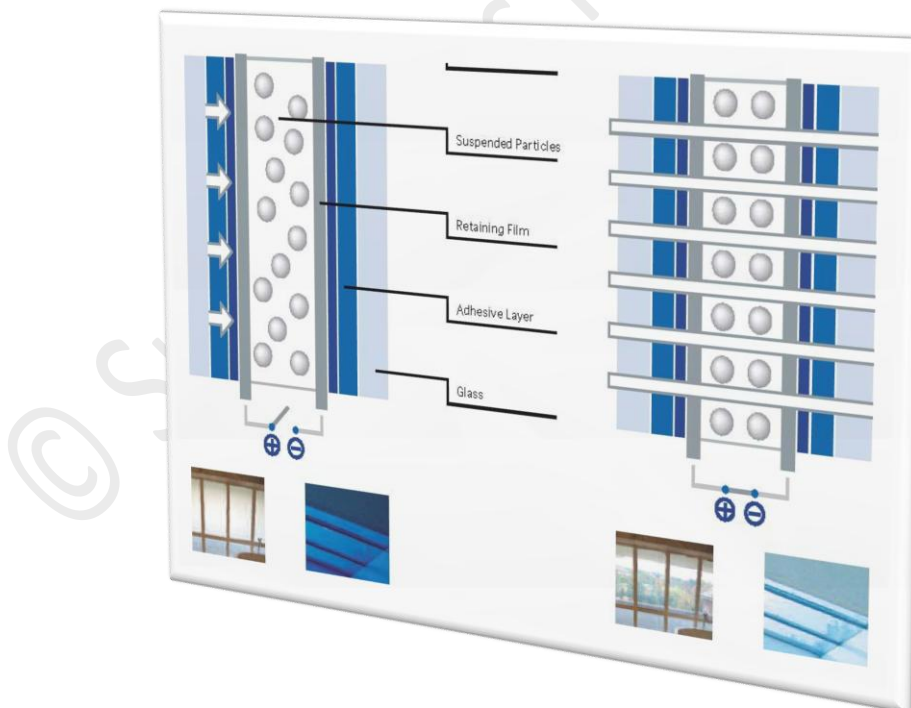
# SPD SmartGlass - Solar Control

## OVERVIEW

SPD-SmartGlass™ can be manually or automatically “tuned” to control the amount of light and glare passing through a window. While glass is a favored product for use in building facades; glare, solar heat gain and UV exposure are problematic and can often make the use of glass impractical resulting in the need to invest in expensive solar shading devices. Glass facades using patented SPD light-control technology reduce the need for air conditioning during the summer months and heating during winter. The ability to instantly switch the glass to maximize daylight when it’s really needed and to provide controllable solar shading during peak light conditions is valuable and unique. All SPD SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a SPD “Suspended Particle Device” film between 2 or more glass sheets.

## PRINCIPLE

When the power supply is switched **on**, the rod shaped suspended particle molecules align, light passes through and the SPD SmartGlass panel clears. SPD SmartGlass protect from damaging UV when on or off. When the power supply is switched **off** the rod shaped suspended particle molecules are randomly oriented blocking light and the SPD SmartGlass becomes dark blocking up to 99.4% of light.



# SPD SmartGlass™ APPLICATIONS & FEATURES

## External Glazing

- Fixed or casement windows and doors
- Create comfortable environments in offices, bedrooms, sunrooms and conservatories.
- Can be used in the marine and aviation industry.
- In SPD SmartGlass Curtain walling, the use of a photocell will automatically protect the interior of a building when the sun's rays shine
- Can be single, double or triple-glazed including low E glass and gas filling, resulting in improved thermal performance and reduced solar heat gain and unparalleled U Values

## Roof-Lights

- Skylights
- Roof-lights – Fixed or opening
- Commercial and Domestic

## Security and Safety

- Protect staff and interiors from the effects of harmful UV rays.
- Reduced harmful solar heat gain.
- Control glare.
- Reduce the effects of noise pollution.
- Added security and safety due to toughened laminated glass construction.
- Low electric consumption.

## ADVANTAGES & BENEFITS

In an effort to reduce glare the windows of many commercial buildings are permanently tinted, therefore requiring more lighting inside the building than that which is optimally needed. Natural day lighting, which can be regulated using SPD SmartGlass™ products, has been shown to improve health and well being, and thus its regulation is considered by many to have a strong influence on one's attitude and productivity.

- Instant and precise control of light
- Energy Savings on cooling & lighting costs
- Eco friendly, reduce building carbon emissions
- Exceptional optical qualities that reduce glare and eye strain
- Elimination of the need for expensive window dressings like electronic louvers; blinds and solar shades used in architectural applications
- High durability, solid-state technology with no moving parts to wear out or break
- Large sizes of any shape can be produced

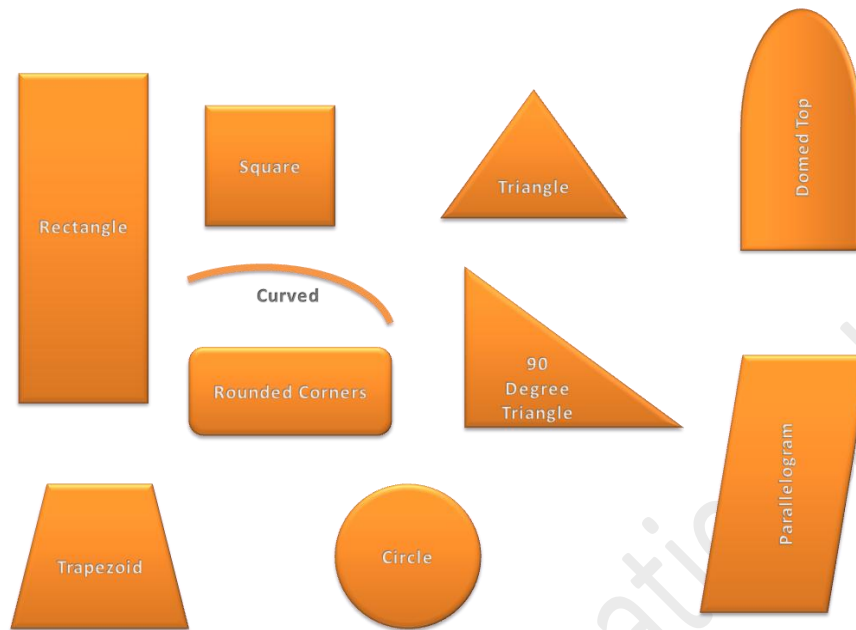


- Stable colour characteristics for the life of the unit
- Wide working temperature range from -20°C to +70°C - Ideal for exterior applications
- Ambient temperature control
- Aesthetically pleasing
- Hygienic low maintenance material
- Enhanced corporate image
- Wide light transmission ranges
- Reduces uncomfortable “Gold fish bowl” feeling when living or working in high-density buildings such as apartment blocks or office complexes
- Reduced fading of carpets, furniture and protect valuable artwork
- Protecting skin from damaging UV rays
- High UV stability
- Low working voltage
- High contrast at any viewing angle and any illumination level
- Long life - tested to in excess of 100,000 cycles
- Cost competitive.
- Infinite range of light transmission levels without the blocking of ones view.

## SPD SmartGlass - CONFIGURATION

- Maximum Size: 1,000 \* 3,000 mm
- Minimum Size: 200 \* 300 mm
- Weight: 35.5 kg/m<sup>2</sup> (24.0mm SPD SmartGlass DGU)
- Thickness: Various from 9.5mm for laminates and from 20mm for Double Glazed units
- Colour tints: Blue
- Glass types: Gas filled double glazed units (external windows)
- Processing: Double Glazed, Drilled Holes, Curved, Shaped, Triple Glazed
- Warranty: 5 Years
- Leadtime: 8-12 weeks
- Control: Wall switch, Remote control, Movement sensor, Light sensor, Timer

## SHAPES



## TRANSMISSION DATA - SPD SmartGlass

	SPD SmartGlass (10.8mm) Power ON	SPD SmartGlass (10.8mm) Power OFF	Clear Float Glass (6mm)	Frosted Glass (6mm)
Visible Light Transmission	49%	0.24%	86%	76%
Clarity	N/A	2.90%	83%	18%
UV Transmission	0.5%	0.5%	55%	55%

\*Values are nominal (+/-5%) and are dependent on the glass configurations used. SmartGlass International reserves to right to amend information without prior notice

## Sound Control Data - SPD SmartGlass\*

SPD SmartGlass Thickness	Configuration	DB Rating
9.2 mm	4 mm / 1.2 / 4 mm	35
11.2 mm	5 mm / 1.2 / 5 mm	37
13.2 mm	6 mm / 1.2 / 6 mm	39
25.2 mm	12 mm / 1.2 / 12 mm	44

\*Results vary according to glass specification and framing system employed. The above figures are recommended for guide purposes only and may change without prior notice.

## MANUFACTURING

The production team at SmartGlass International Ltd uses a combination of experience, technology and skill to manufacture each SmartGlass panel to the highest levels of quality. In house proprietary manufacturing processes using an Autoclave lamination process employ heat, vacuum and pressure to produce a multilayer glass sandwich. Each SmartGlass panel is handmade & bespoke for the clients requirements. The production cycle lead time for each panel is 3-5 days depending on configuration.

All of the materials used in the production process are of world class standard and while expensive; these materials ensure premium quality in the finished product.

Each SmartGlass panel is assembled in a climate controlled clean room environment. Production employees are empowered to strive for World class manufacturing standards and individually sign off each bespoke made panel after manufacturing and testing.

After manufacturing, cleaning and wiring each SmartGlass panel is tested by switching approximately 57,000 times in rapid on/off sequence.

SmartGlass can be manufactured into various shapes including holes in the film. (Contact us for detailed explanation) All panels are bespoke manufactured and **cannot** be cut after manufacture.

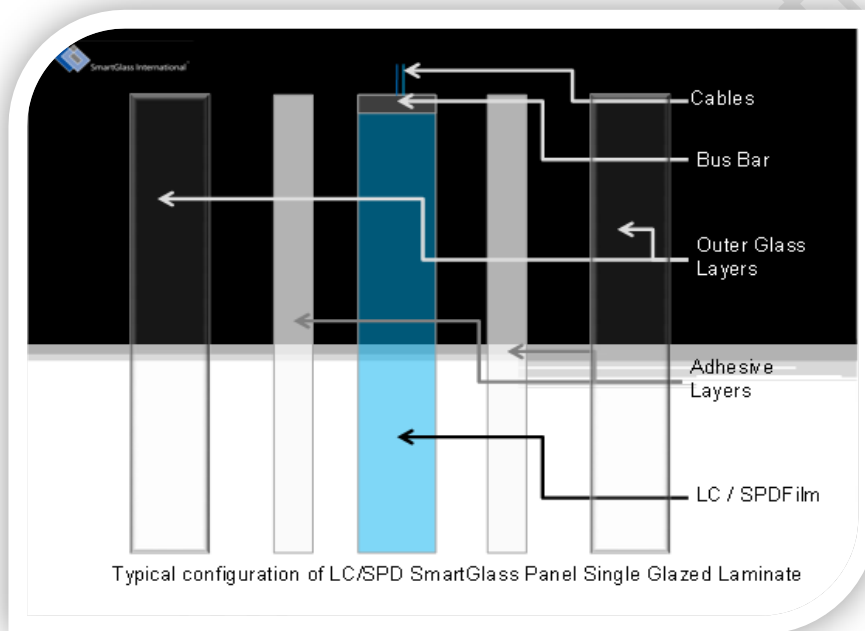
SmartGlass™ is real life field tested for in excess of 14 years.

## SMARTGLASS PANEL

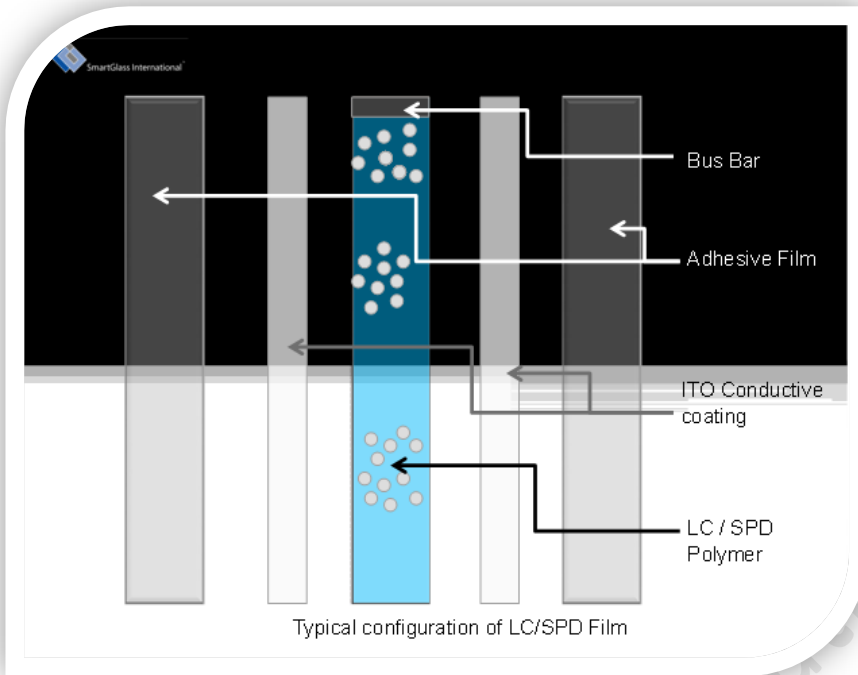
LC & SPD Smart films are laminated between two or more pieces of glass.

Liquid crystals - the same technology is used in digital watches, TV's and computer screens. Liquid crystals are sandwiched between two layers of transparent conductive film to make LC Smart Film. The film is then laminated between two pieces of glass. When electricity is applied to the film the liquid crystals line up and the window is clear (**slight haze**). When the power is turned off, the liquid crystals return to their normal positions and turn the glass from clear to opaque. 2 wires exit the top of each unit where they are connected to a copper bus bar.

**Note:** Framing needs to hide 15 mm where the bus bar is visible, generally at the top of the SmartGlass panel.



The electro active Smart film is sandwiched between two or more glass layers in a similar way to how normal laminated glass is constructed. The outer layers are made up of glass (normally 5 mm or 6 mm thick) each side, then an interlayer is inserted on each side to encapsulate the Smart film and bond the complete laminate.



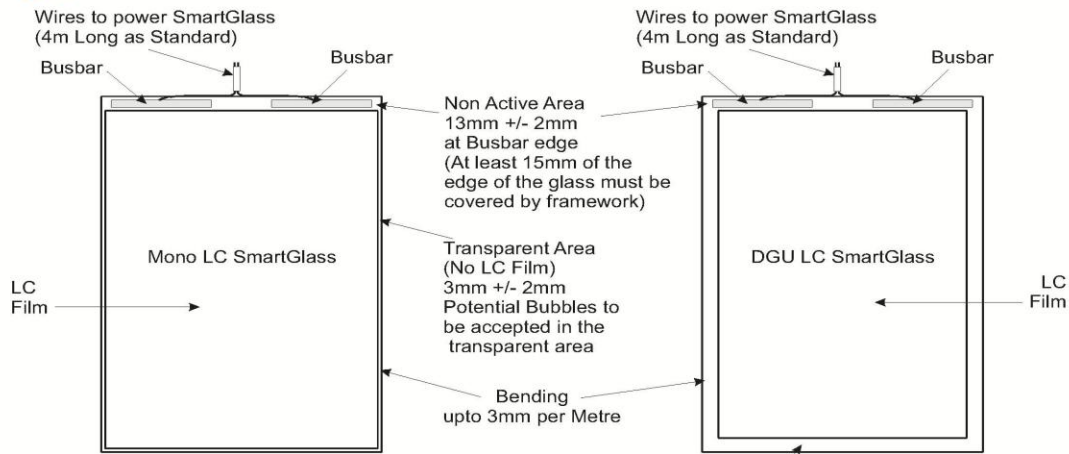
LC & SPD Smart film's are manufactured using electrically conductive ITO coatings, polymer matrix', liquid crystals or suspended particles, adhesive films and bus bars.

## SPECIFICATION OF LC & SPD SMARTGLASS



SmartGlass International

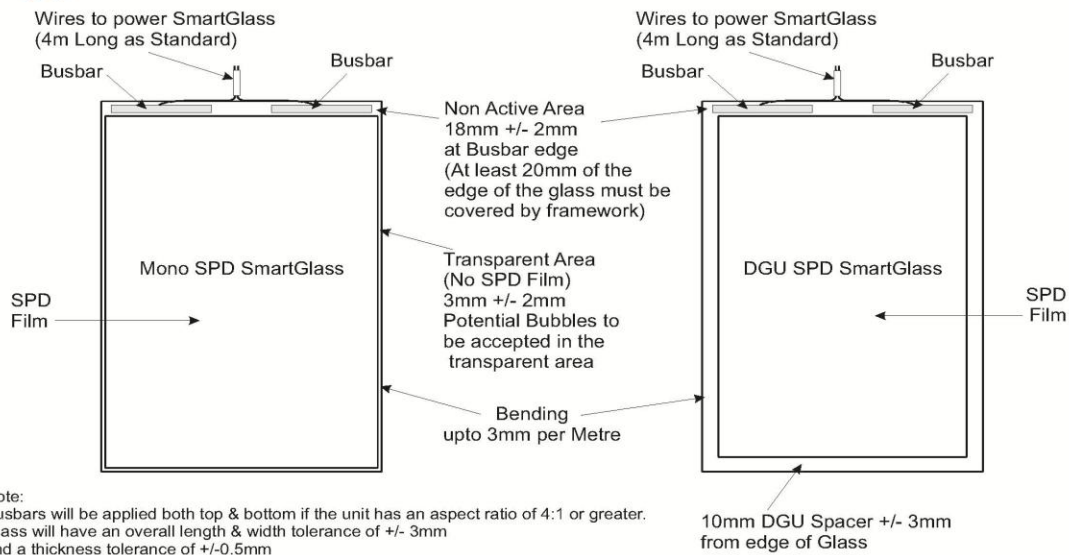
Specifications of LC SmartGlass



Note:  
Busbars will be applied both top & bottom if the unit has an aspect ratio of 4:1 or greater.  
Glass will have an overall length & width tolerance of +/- 3mm  
and a thickness tolerance of +/- 0.5mm

Wire is: RS 491-829 - 2192Y 0.5mm 2 core 16/0.2mm - Black  
(Sheath 3.0-3.6mm x 4.8-6.0mm)

SmartGlass Drawing No. STD02c



Note:  
 Busbars will be applied both top & bottom if the unit has an aspect ratio of 4:1 or greater.  
 Glass will have an overall length & width tolerance of +/- 3mm and a thickness tolerance of +/-0.5mm

Wire is: RS 491-829 - 2192Y 0.5mm 2 core 16/0.2mm - Black (Sheath 3.0-3.6mm x 4.8-6.0mm)

SmartGlass Drawing No. STD03a

## SmartGlass - Transmission & Test Data

### Energy Transmission Measurements

To provide a better understanding of what these figures are measuring, the brief explanation below discusses the various spectrums of energy created by the sun. These are the same energy spectrums that building products and windows must endure on a daily basis. Some of the characteristics are positive and ones that we want to maximize, while others are detrimental and must be reduced or controlled in some manner.

Electromagnetic energy from the sun is broken into a variety of categories or spectrums based on the wavelength of the energy. The three main spectrums that affect the building products industry, people and furnishings in commercial and domestic settings are UV, Visible Light and Infrared energy. Read on to see how SmartGlass can not only achieve immediate privacy on demand but can control, protect and enhance building environments.

### ULTRA VIOLET - UV

UV energy is not visible to the human eye and is typically broken into three categories: UVA, UVB, and UVC. UVC energy is mostly rejected by the earth's atmosphere, never reaching the earth's surface. UVB and UVA energy pass through the atmosphere and reach the earth's surface. As it pertains to the window market, most of the UVB energy is blocked by standard float glass. Clear double pane windows will reject almost all of the UVB energy. Therefore the remaining UVA energy is the primary target. UVA energy passes through standard float glass, and can only be blocked by coatings or films that are capable of reflecting or absorbing this spectrum of light such as our SmartGlass technologies. UVA energy is the primary component responsible for fading of furnishings, art work and overall deterioration of fabric quality. The more a window product can reject or absorb the sun's UV energy,

the longer the life and quality of the items being protected. All window products should strive for the lowest UV transmission value possible.

## VISIBLE LIGHT

Visible light is the only portion of the sun's spectrum that human eyes can see including natural daylight and all the colours of the rainbow. Visible light has mostly good attributes associated with it but eye strain associated with glare can cause serious problems for building occupiers. Natural light is often desired to make a home or building feel open or well lit. Large amounts of natural light will also reduce the need for lighting in a given structure, thus reducing utility costs. Windows that are tinted will have lower visible light transmission values. It should be noted that large amounts of natural light can also increase the amount of glare. This unwanted element can be aggravating in rooms with televisions or computer monitors and areas in office buildings where employees have to combat uncomfortable and often dangerous glare levels. SmartGlass allows the user to control visible light transmission and by choosing grey or blue tinted versions for specifically bright areas the user is protected and inhabits a safer and more comfortable environment.

## INFARED – IR

Infrared energy relates to the heat energy that is emitted from the sun and is also referred to as radiant heat. Infrared energy is light that our eyes cannot see, but which our bodies can detect as heat. The radiant heat energy emitted by the sun in the solar spectrum is typically classified as Near Infrared (NIR) energy. This is the energy one feels as heat when standing in the sun. This is the same energy that hits a window surface and transmits through the glass to increase the temperature inside a building. Being able to "control" this near infrared energy transmission value allows a window to control the amount of heat that is added to a building by the sun. Decreasing the infrared transmission value of a window will decrease the amount of heat energy added to a building, thus reducing over-heating effects that occur in summer months and in hot climates. The use of SmartGlass protects building occupants and significantly reduces carbon emissions and costs associated with air conditioning and cooling. The ability of a window using LC SmartGlass™ to reject infrared energy will be directly related to a window's Solar Heat Gain Coefficient (SHGC). The lower the Infrared Transmission Value the lower the corresponding Solar Heat Gain Coefficient.

**Evidence of Performance**  
light transmittance  
light reflectance

Test report 410 33071e



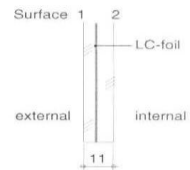
Customer **SmartGlass International Ltd.**  
Unit6 Renmore Business Complex  
Kilcoole

County Wicklow  
Ireland

**Basis**  
EN 410 : 1998-04  
Glass in building – Determination of luminous and solar characteristics of glazing

Product	Laminated glass
System designation	LC SmartGlass™
Construction	4 float / 1 LC-foil / 6 float

**Representation**



**Instructions for use**

This test report may be used to classify the light transmittance  $\tau_v$  and the light reflectance  $\rho_v$ .

**Validity**

The data and results given relate solely to the described, tested object.  
Testing the total solar energy transmittance does not allow any statement to be made on further characteristics of the present structure which could define performance and quality.

**Notes on publication**

The ift Guideline "Conditions and Guideline on the Use of ift Test Reports" applies.

The cover sheet can be used as an abstract.

**Contents**

The report contains 4 pages in total

- 1 Object
- 2 Procedure
- 3 Detailed results

Light transmittance  $\tau_v$   
Light reflectance  $\rho_v$



Opaque state

$$\tau_v = 0,67$$

$$\rho_v = 0,18$$

Transparent state

$$\tau_v = 0,75$$

$$\rho_v = 0,14$$



ift Rosenheim  
4 July 2007

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*Böck F.*

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02-07 / 390



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Notified Body Nr: 0757  
Anerkannte PUZ-Stelle BAY 18  
DAF-PL 0808 99  
DAF-ZF 2398 00  
TSK-ZM 18 09 00  
TSK-ZM 16 03 00





## 1 Object

### 1.1 Description of test specimen (all dimensions in mm)

<b>Product</b>	Laminated glass
Type	LC SmartGlass™
Total thickness	11
construction	4 float / 1 LC-foil / 6 float

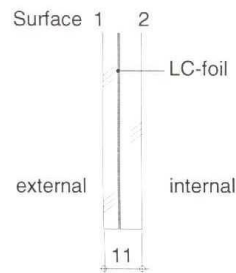
For the determination of the spectral data test specimen of single panes were used:

Dimensions (B x H)	80 x 300 mm, 300 x 300 mm
Glass thickness	11

The description is based on the documentation of **ift**. Numbers and names of material are given by the customer. (Further data from customer are marked with \*).

### 1.2 Representation of test specimen

The illustration was produced by the **ift** as a schematic representation of the cross section.



**Figure 1** Representation of the system  
LC SmartGlass™



## 2 Procedure

### 2.1 Sample

The specimen were selected by the customer.

Quantity	80 x 300 mm, 3 peaces 300 x 300 mm, 3 peaces
Delivered	16 April 2007 by the customer
Registry No	21783

### 2.2 Process

Technical basis	
EN 410 : 1998-04	Glass in building – Determination of luminous and solar characteristics of glazing
Deviations	There are no deviations from the test procedure or test conditions

### 2.3 Test equipment

IR-Spectrometer	Equipment No 22133
Type	Shimadzu UV-3102PC with LISR-3100, Integration sphere Ø150 mm
Measured range	190 nm to 2500 nm
Resolution	variable, 2 nm was selected
Climatic conditions	approx 20 °C, 50 % RH
Reflection standard	calibrated reflection standard, Fa. Labsphere; aluminium mirror
Averaging	average of three samples

### 2.4 Execution of the test

Date/period	31 May till 2 July 2007
Test engineer	F. Böck



### 3 Detailed results

**Table 1** Measured and calculated values according to EN 410 for light at normal incidence for the laminated glass LC SmartGlass™

		<b>opaque</b>	<b>transparent</b>
Ultraviolet transmittance	$\tau_{UV}$	0.18	0.23
<b>Light transmittance</b>	$\tau_v$	<b>0.67</b>	<b>0.75</b>
<b>Light reflectance</b>	$\rho_v$	<b>0.18</b>	<b>0.14</b>
Solar direct transmittance	$\tau_e$	0.61	0.65
Solar direct reflectance	$\rho_e$	0.15	0.12

ift Rosenheim  
4 July 2007

**Evidence of Performance**  
total solar energy transmittance  
light transmittance

Test report 410 33071/2e

\* Translation of test report n° 410 33071/2 dated 31 October 2007

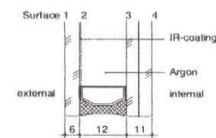


Client **SmartGlass International Ltd.**  
**Unit6 Renmore Business Complex**  
**Kilcoole, County Wicklow**  
**Ireland**

Basis  
EN 410 : 1998-04  
Glass in building – Determination of luminous and solar characteristics of glazing

Product **Insulating glass unit**  
System designation **Insulating glass unit with LC-Glass**  
Construction **6/12/11 mm**  
Gas filling **90 % Argon**  
Type of coating **IR-Coating on surface 2**  
Coating designation **arcon N33, arcon sunbelt platin**  
Uncoated pane **LC-Glass**

Representation



Instructions for use

This test report may be used to classify the total solar energy transmittance  $\tau_g$  as well as the light transmittance  $\tau_v$ .

Total solar energy transmittance  $g$   
Light transmittance  $\tau_v$



$g = 0.39$  to  $0.51^*$   
 $\tau_v = 0.54$  to  $0.65^*$

\* Exact value see table detailed results

Validity

The data and results given relate solely to the described, tested object.

Testing the total solar energy transmittance does not allow any statement to be made on further characteristics of the present structure, which could define performance and quality.

Notes on publication

The ift Guideline "Conditions and Guideline on the Use of ift Test Reports" applies.

The cover sheet can be used as an abstract.

Contents

The report contains a total of 4 pages

- 1 Object
- 2 Procedure
- 3 Detailed results

ift Rosenheim  
16. novembre 2007

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Kto 3822  
BLZ 711 500 00

Notified Body Nr. 0757  
Anerkannte PUZ-Stelle: BAY 18  
  
GAR  
Geometrische  
Prüfung  
Technische  
Prüfung  
Mechanische  
Prüfung  
Elektrotechnische  
Prüfung  
Chemische  
Prüfung  
Physikalische  
Prüfung  
Strahlenschutz  
Prüfung  
Schweißtechnik  
Prüfung  
Schweißtechnik  
Prüfung  
Schweißtechnik  
Prüfung

## 1 Object

### 1.1 Description of test specimen (all dimensions in mm)

<b>Product</b>	Insulating glass unit
Type	Insulating glass unit with LC-Glass
Total thickness	29
Construction	<u>6/12/11</u>
Coating	Thermal protection coating
Type / Manufacturer	arcon N33 / company Arcon
Coating on surface	2
normal emissivity $\epsilon_n$	0.03
or	
Coating	Solar control coating
Type / Manufacturer	arcon sunbelt platin / company Arcon
Coating on surface	2
normal emissivity $\epsilon_n$	0.03
Gas filling in cavity	according to manufacturer
Gas type	Argon
Volume in %	90

For the determination of the spectral data test specimen of Insulating glass unit with LC-Glass™ single panes were used:

Dimensions (B x H)	80 x 300 mm, 300 x 300 mm
Glass thickness	11

The description is based on the documentation of **ift**. Numbers and names of material are given by the customer. (Further data from customer are marked with \*).

### 1.2 Representation of test specimen

The illustration was produced by the **ift** as a schematic representation of the cross section.

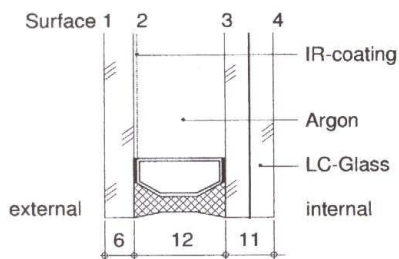


Fig. 1 Representation



## 2 Procedure

### 2.1 Sampling

The samples were selected by the client.

Quantity	3
Delivered	16 April 2007 by the client
Registration No.	21783

The spectral data of the coated single pane (coating arcon N33 and arcon sunbelt platin, company Arcon, thickness 4 mm) was taken from the ift certificate 697 7032482. The coating of the single pane arcon N 33 has been extrapolated from 4 mm to 6 mm substrate according to EN 410, Annex A.

### 2.2 Process

Technical basis	
EN 410 : 1998-04	Glass in building – Determination of luminous and solar characteristics of glazing
Deviations	There are the following deviations from the test procedure and/or test conditions: Due to the light dispersion (LC-Glass), additional measurements according to DIN 5036 have been made with a 1.25 integration sphere.
Uncoated pane	Laminated glass of the client

### 2.3 Test equipment

IR-Spectrometer	Equipment No 22133
Type	Shimadzu UV-3102PC with LISR-3100, Integration sphere Ø150 mm
Measured range	190 nm to 2500 nm
Resolution	variable, 2 nm was selected
Climatic conditions	approx 20 °C, 50 % RH
Reflection standard	calibrated reflection standard, company Labsphere; aluminium mirror
Averaging	average of three samples

### 2.4 Testing

Date/Period	31 May - 31 August 2007
Testing personnel	F. Böck



### 3 Detailed results

Coating		arcon N33 <sup>3)</sup>		arcon sunbelt platin <sup>3)</sup>	
		opaque	transparent	opaque	transparent
State of the LC Glass					
$U_g$ <sup>1)</sup> in W/(m <sup>2</sup> K)	$U_g$	1.3	1.3	1.3	1.3
Ultraviolet transmittance	$\tau_{UV}$	0.06	0.08	0.04	0.06
<b>Light transmittance</b>	$\tau_v$	<b>0.58</b>	<b>0.65</b>	<b>0.54</b>	<b>0.60</b>
Light reflectance (external)	$\rho_v$	0.21	0.18	0.18	0.15
Solar transmittance	$\tau_e$	0.38	0.41	0.30	0.33
Solar reflectance (external)	$\rho_e$	0.29	0.27	0.31	0.30
Secondary internal heat transfer factor	$q_i$	0.11	0.10	0.09	0.08
<b>Total solar energy transmittance</b> ( $g = \tau_e + q_i$ )	$g$	<b>0.49</b>	<b>0.51</b>	<b>0.39</b>	<b>0.41</b>
Shading coefficient (b-Factor) <sup>2)</sup>	$b$	0.61	0.64	0.49	0.51

<sup>1)</sup>  $U_g$  according to calculation DIN EN 673

<sup>2)</sup> Shading coefficient (b-Factor)  $b = g/0.8$  according to VDI-Guideline 2078

<sup>3)</sup> Coating on surface 2

ift Rosenheim  
 16. November 2007

**SCHOTT AG**  
Werk Grünenplan

**SCHOTT**

Verteiler:

ATQ-21/Schm  
Kevin Root (SmartGlass)

z. K.:

ATQ/Düs  
ATV-N/StR  
ATV-QVH

Grünenplan, 12.02.09  
17.02.09  
ATV-Q / We

**Test results A02/09**

Product/Sample: Laminated Glas – LC SmartGlass,™ ca. 8,8 mm Glass thickness

Task: Check on chemical resistance acc. DIN EN ISO 12543-4

Results/Tests

Glass No 1-3

**Humidity test with condensation CH (KK)-Test /+ 50 °C:**

after 336 hours: OK no attack in the laminate,  
slight change of colour.  
(circular slightly infiltrated humidity )  
Spots on the glass surface

Glass No 2

Glass No 1-2

**High temperature Test (Boiltest) (2 sample because we needed 1 reference sample**

After 2 hours: OK no attack in the laminate,  
slightly change of colour

Notice:

1 Reference sample

Conclusion:

Test results okay. No attack / no failure, only slight change of colour.

See E-Mail Kevin Root 16.02.2009

The samples have passed all the tests. The discolouration is acceptable.

...



**LC SmartGlass is certified IPX7 rated and tested in accordance with BS EN 60529:1992.**

Please contact us or see [http://www.smartglassinternational.com/downloads/IPX7\\_Certificate.pdf](http://www.smartglassinternational.com/downloads/IPX7_Certificate.pdf)

## BALLISTIC RESULTS

Lc Smartglass has passed a number of ballistic tests with many different combinations of laminated glass and with many different calibre rounds. Please contact us for further information and test results.

## HAZE

It should be noted that LC SmartGlass is *not* optically as clear as normal float glass. A haze in the form of clouding in the glass is considered normal and is unavoidable due to the nature of the product makeup. It should also be noted that ambient lighting conditions will have an effect on haze levels; direct lighting onto LC SmartGlass should be avoided. Every precaution has been taken to ensure minimum haze. Tinted glass can be used to reduce the visible haze such as blue, green or grey tints. It is essential that the end client understands that *a degree of haze will be present depending on configuration and will not be considered as a reason for exchange or refund.*

## GLASS

1. Where used, all tempered glass complies with BS6206A.
2. Will be provided in the type and thickness shown on the project drawings or specified to the client.
3. Where glass type is not shown on the drawings or as specified, type and thickness will be supplied as directed by the Architect, main contractor or designer.
4. Where applicable LC SmartGlass™ panel will receive a permanently etched safety certification label unless specifically directed by the Architect.
5. Each SmartGlass panel will contain an identifying label.
6. Float glass-clear: Type 1, Class 1.
7. Fire Rated glass: Borosilicate, BS 476: Part 22 (Subject to conditions).
8. Laminated Safety Glass
9. Specialist glass can be requested for use in specific applications.

# GLAZING GUIDELINES

## Interior Butt Joint Glazing

SmartGlass™ panels can be butt glazed using a recommended minimum of 9 mm in glass thickness. Long edges will be polished giving an even vertical finish. Panel thickness will vary depending on several conditions including the height and span of the glazed area. We will recommend the ideal glass thickness to protect against bowing and to provide safety, fitness for purpose and adherence with legislative guidelines.

A standard neutral cure structural silicone sealant may be used to close the joint as specified by us. A minimum of a 4 mm separation between panels is recommended. Alternatively a plastic “H” section will be used instead of silicone to dry join panels.

Refer to applicable local building guides for design load requirements regarding interior glazing. Safety and suitability for purpose will be treated as the main driving factors in assessing suitability for butt joint glazing. Note: Not all internal applications will be suitable for butt joint glazing and support framing may be required.

## Operable Doors & Windows

Swing door & windows can be glazed with SmartGlass.

Cable connectors will be used to protect wires travelling between the door and frame where the wiring is then connected to the transformer/ power conditioner. Contact switches can also be used.



FDL1 300\*10MM FLEXIBLE LOOP



CDL1 291\*26MM CONCEALED DOOR LOOP

## INSTALLATION

Clients and their installers should inspect each piece of SmartGlass immediately prior to start of installation.

Do not install items which are improperly sized, have damaged edges, or are scratched, abraded, or deficient in any other manner.

Do not remove labels where provided by SmartGlass International until so directed by the Architect, client or site manager.

Adhere to all LC SmartGlass™ installation instructions and installation drawings.

Locate setting blocks of standard width and thickness at quarter points of all glass panels unless otherwise recommended by manufacturer or supplier.

Use setting blocks of proper durometer, size and thickness to support the glass in accordance with the manufacturers' recommendations.

Glass lap and edge clearances must be provided according to relevant standards of the manufacturers.

If the installer has any questions or concerns, please immediately contact your local SmartGlass representative.

## SURFACE CONDITIONS

Examine the areas and conditions under which work of this section will be performed. Correct and make good conditions detrimental to timely and proper completion of this work. Do not proceed until unsatisfactory conditions are corrected. After preparation of the glazing system the glazing channels, stops and gaskets should be cleaned to receive the SmartGlass materials, making free from obstructions and substances which might impair the work at hand. Comply with manufacturers' instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes

**USE ONLY RECOMMENDED NEUTRAL CURE SILICONES. DO NOT USE ACETIC SILICONES.**

Install glass in a manner which produces the greatest possible degree of uniformity of appearance.

Do not install glass in dynamic frames such as operable windows or sliding doors, without the consent of SmartGlass International Ltd.

Glazing to exterior and wet interior conditions must be wet-sealed and impervious to moisture with provisions to allow for weeping of condensation that may infiltrate of condensation in the system. Electrical connections must exit at the head of any framing system using SmartGlass panels in wet environment applications

Pressure glazing systems without positive positioning stops are **not** to be used with SmartGlass.

The glazier should place all electrical connections & wires properly to allow easy access by an electrician.

Cut and seal joints of glazing gaskets in accordance with the manufacturers' recommendations to provide watertight and airtight seal at corners and other locations where joints are required.

## GLAZING METHODS

Wet Glazing: If an elastomeric (non-acetic) sealant is used, it must be compatible with the SmartGlass panel interlayer. **Never** use putty or glazing compound to glaze SmartGlass.

Exterior Applications - Insulated Glass Units made with SmartGlass can be installed as per normal glazing with the exception of accommodating the unit wiring. SmartGlass is suitable for glazing to steel, timber, aluminium and UPVC framing systems.

Wet Glazing: Pre-shimmed glazing tape and non-acetic sealants are required to create a seal impervious to moisture for all exterior applications.

Butt-Joint Glazing: SmartGlass panels can be butt-joint glazed in interior applications (Long edges polished recommended).

### Non-Acetic Sealants

Smartglass International Ltd only recommends **SODAL SLIRUB 2** as the sealant for use in butt-joint glazed SmartGlass panel systems.

Structural Silicone Glazing: Insulated glass units manufactured with SmartGlass should not be structurally silicone glazed unless agreed in advance by SmartGlass International.

## FRAME DESIGN

Frame edge clearance and face clearances may be used, except the edge bite must be 10 mm minimum and framing must include a hole of 6 mm diameter to pass wires through. To maintain a proper seal against the infiltration of water and air adequate bite and sealing is required.

Inadequate clearance for the edges can cause damage due to glass-to-metal contact. Minimum **edge clearances** should allow for a tolerance of  $\pm 1.5$ mm. This should only be increased if the surrounding materials tolerances are difficult or impossible to control.

The industry standard for framing deflection must be adhered to. The **deflection** must not exceed either the length of the span divided by 175, or 18 mm, whichever is less. All expansion joints and anchors must be designed so that the glass framing does not incur a load due to structural movement.

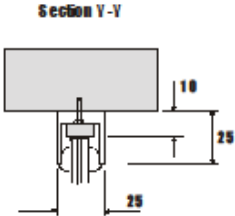
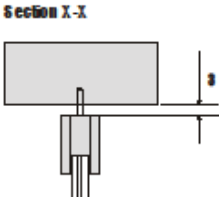
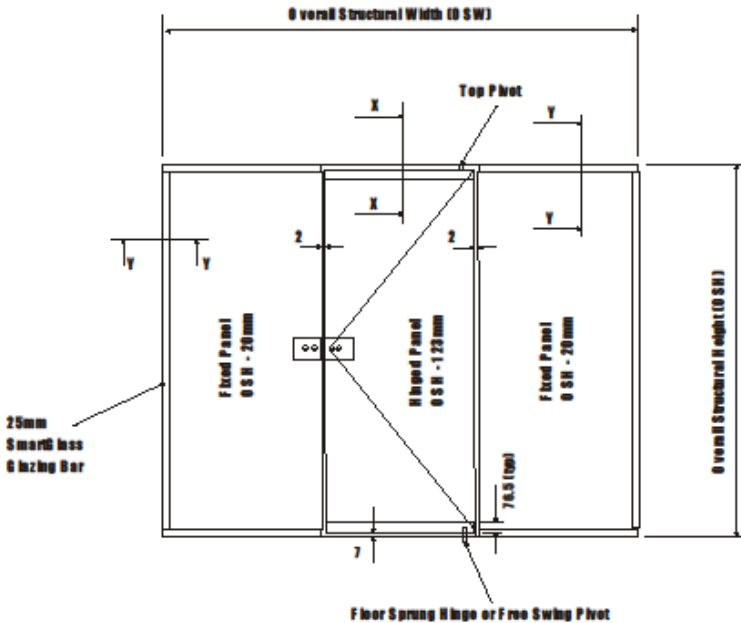
Glass larger than .66 square meters should be placed on four EPDM or neoprene **setting blocks**. These blocks should have a durometer hardness of  $85 \pm 5$ . They should be centred at the bottom quarter points (i.e. equal distance). The blocks should be 1.5 mm narrower than the channel width. Lock-strip gasket systems also require setting blocks. Recommendations can be obtained from the gasket manufacturers.

Once the SmartGlass is installed, the architect, general contractor, or building owner should provide for glass **protection and cleaning**. Weathering steel such as Cor-Ten or alkaline materials may cause surface damage due to staining. **Abrasive cleaners should never be used**, particularly when the surface to be cleaned has a reflective coating. Windblown objects, welding sparks, plaster, or other material applied to the glass surface during construction may cause irreversible damage.

SmartGlass International Ltd will not be held liable for damage caused by others; the main contractor is responsible for protection of glass on site following delivery & installation.

# PLEASE SEE ILLUSTRATIONS BELOW FOR TYPICAL GLAZING SYSTEMS USED

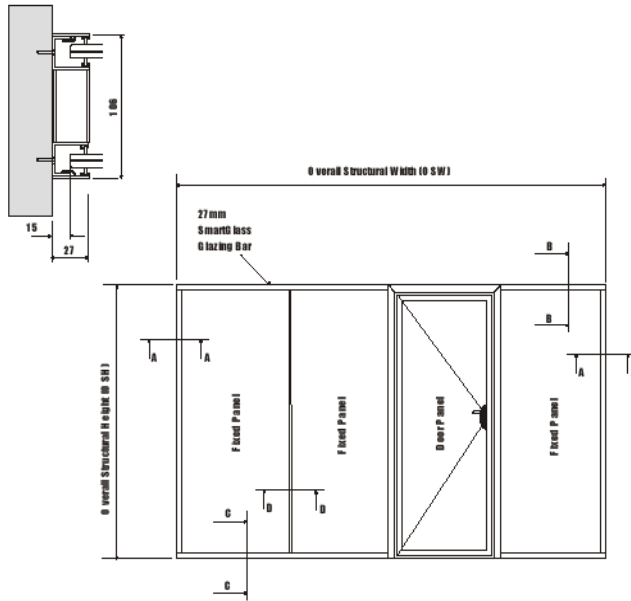
## SmartGlass Door System



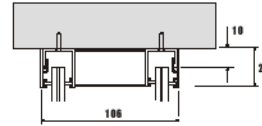
**Not to Scale**

## SmartGlass Door System 45dB

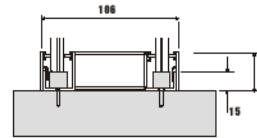
Section A-A



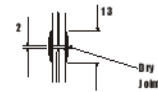
Section B-B



Section G-G



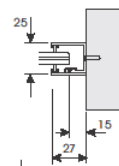
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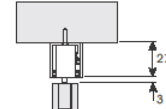
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## SmartGlass End Door System with Dry Joints

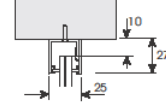
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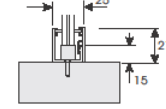
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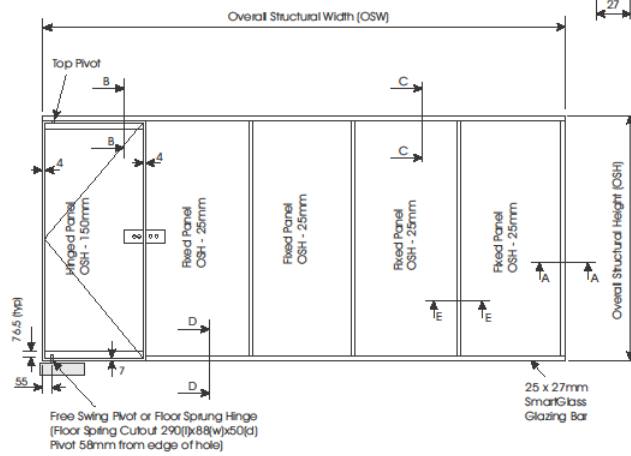
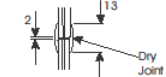
Section C-C



Section D-D



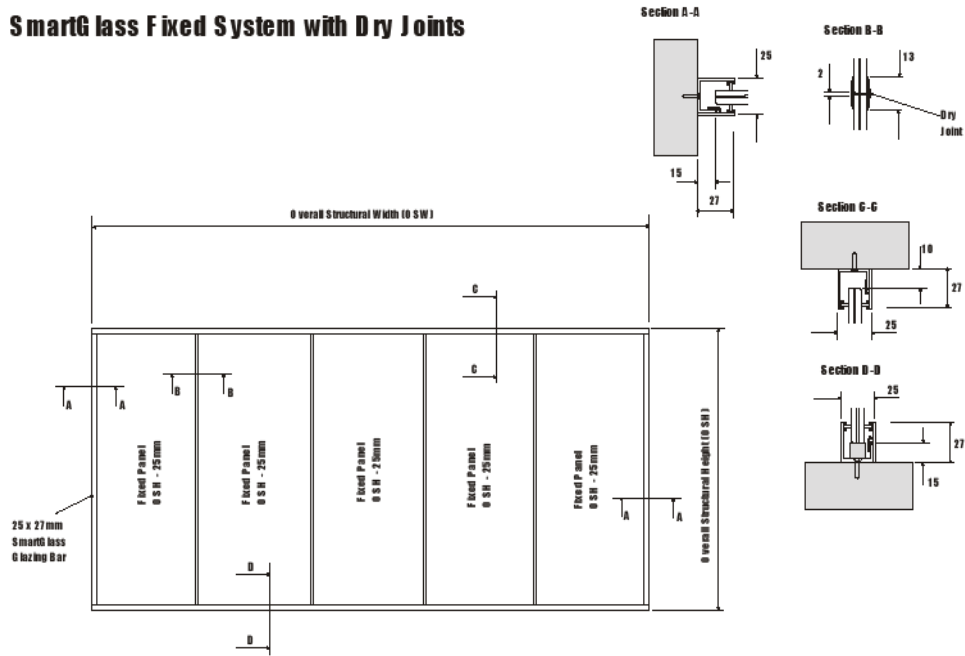
Section E-E



Not to Scale

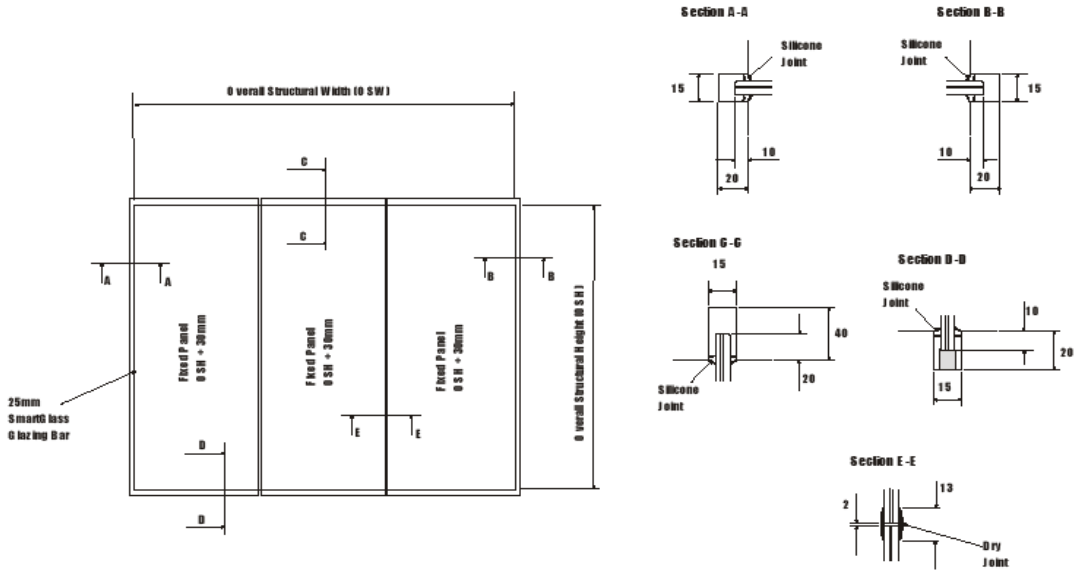


### SmartGlass Fixed System with Dry Joints



Not to Scale

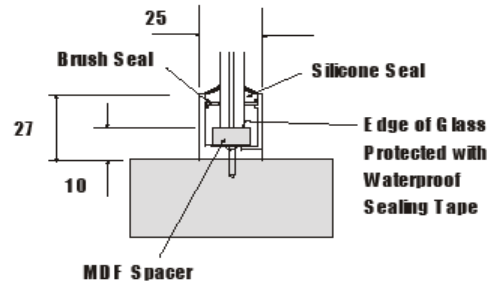
### SmartGlass Fixed System with Dry Joints (No Frame)



Not to Scale

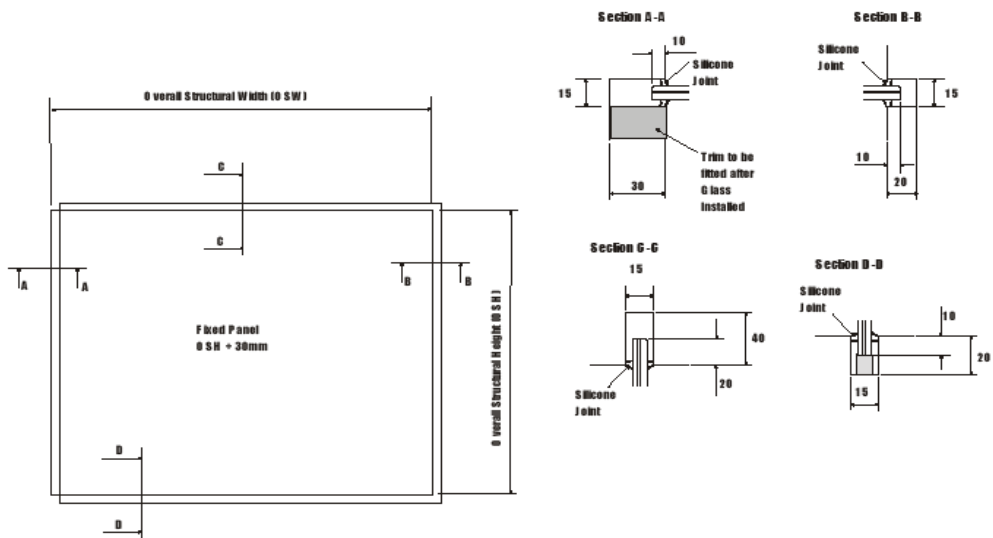


### SmartGlass Frame in Wet Area



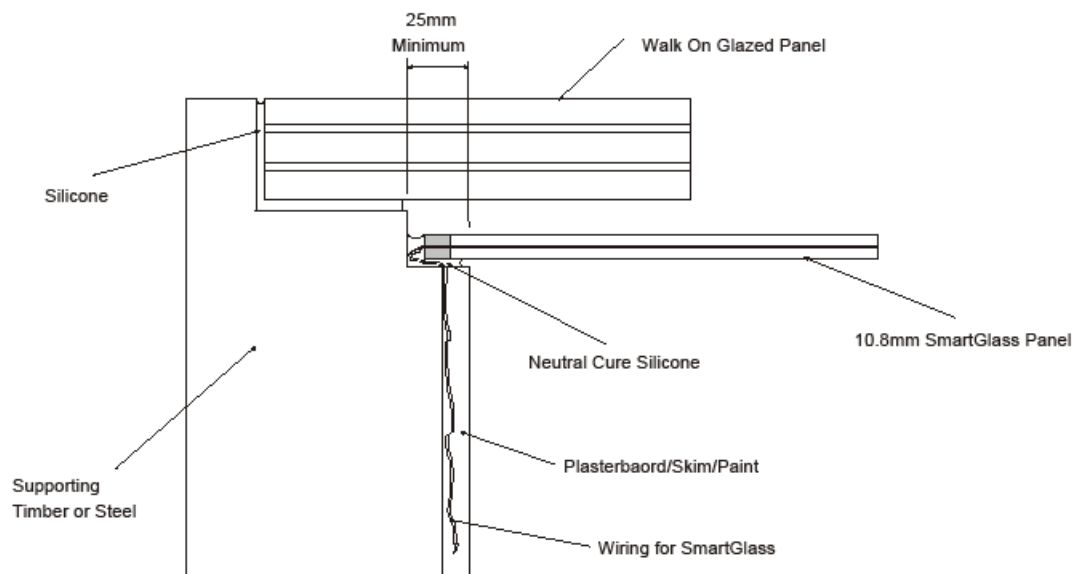
Not to Scale

### SmartGlass Single Fixed Panel (No Frame)



Not to Scale

## SmartGlass under Walk On Unit



## SHIPPING AND RECEIVING

### SHIPPING

Where applicable we manufacture shipping crates for all individual customer orders. These crates allow for protection of glass in transit but correct handling methods should be observed when off loading. **Note:** It is the responsibility of the client to off load glass deliveries unless otherwise agreed prior to dispatch.

If no preferred carrier is specified, the SmartGlass panels for domestic customers will be shipped through our ground carriers. For overseas customers, specifying whether the freight should be shipped via Air or Sea is necessary. Where available, it is recommended to have the clients own agent to take care of the shipping and customs clearance issues. We can do so, at additional cost.

Due to the difficulty in estimating the accurate weight and dimensions of the crate at the time of giving a quotation, the panels will be shipped **Freight Collect with the full value insured**. Alternatively an estimate will be provided and confirmed prior to despatch.

## RECEIVING

Before signing for and accepting the shipment from the carrier, inspect the crate(s) for the following items:

- a. Inspect crate(s) for visible damage.
- b. Check Tip 'N Tell indicator where used.

If damage to any of the panel(s) is found, the shipping documents should be so noted and the driver's signature obtained as a witness. You should inform SmartGlass International immediately of any damaged panels. Photographs should be furnished within 24 hours. A freight claim should be filed to the carrier as early as possible. **If you fail to inspect the shipment, the carrier and SmartGlass International Ltd. are *not* responsible for damage.**

## UNCRATING

Ensure the crate is on a level surface. Before removing the lid unscrew screws which are holding the lid down. Be careful to lift the lid off the crate level on all corners. Remove straps holding panels on. Remove the panels carefully, one at a time, using the appropriate lifting methods.

**Warning:** Loose cables from LC SmartGlass panels are not to be used for lifting, moving or positioning the LC SmartGlass™ panels. Ensure not to snag cables whilst lifting.

## STORAGE

Glass edges frequently sustain damage due to careless handling at some point between manufacture and installation, Handle with care. If the SmartGlass is to be stored on the job site or in warehouse conditions, proper blocking and protection should be maintained at all times. As with other flat glass products, the SmartGlass panels must be stored where the relative humidity is less than 80% to prevent the SmartGlass from staining. The SmartGlass temperature should be held nearly constant to prevent moisture condensation on the panels. Storage temperature range is -20 +50 °C (-4° +122°F). The crate should be kept in an upright position or tilted at 5° - 7° from vertical at all times using broad, sturdy uprights to support the weight of the crate. Alternatively the SmartGlass should be stored on a glass "A" frame in a position free from obstruction, traffic and danger.

**Note:** SmartGlass panels can be heavy at approximately 27.5 kg/m<sup>2</sup>. Please be careful and take the weight loads into account when moving and storing.

## UNEXPECTED BREAKAGE

"Unexplained" glass breakage may occur after all precautions have been taken. Such breakage is beyond the control of the manufacturer and therefore not warrantable. This includes but is not limited to the following items

- Thermal stress
- Glazing system pressures
- Damage during glazing by others
- Handling and storage problems
- Excessive wind loads
- Objects and debris striking the glass
- Damage by persons/objects at the construction site

## WARRANTIES

SmartGlass International Ltd. warrants that the physically tangible hardware products delivered should be free from defects in materials and workmanship, assuming normal use, for a period of five years from the date of invoice unless otherwise specified. SmartGlass International Ltd' sole obligation and clients sole remedy in the event of breach of warranty is to repair or replace the defective products. The distributor/customer should promptly notify SmartGlass International Ltd of any defect in products delivered there under, and upon obtaining a return authorisation should ship the defective goods to SmartGlass International Ltd for analysis unless otherwise agreed. SmartGlass International Ltd will bear the expense to repair or replace the products supplied but will not accept any costs incurred by others which are associated with, access, removal or replacement / installation of the goods. SmartGlass International Ltd. is not responsible for products damaged by external events such as, but not limited to catastrophe, incorrect silicone use, improper use, or maintenance or use of unauthorised parts.

The installer shall warrant for five years the satisfactory performance of the window or partition installation which includes window, framing, glass glazing, anchorage, and electrical work as detailed by the specifications and approved drawings.

# ELECTRICAL INSTALLATION

## SUPPLIES NEEDED

Installation of SmartGlass panels require the following items:

A 16 AMP (minimum) Residual current device (Rcd) with Miniature circuit breaker (Mcb) or a Residual current circuit breaker with overload protection (Rcbo) must be used along with a fused spur at the connection point for the panel for localised isolation.

A wall mounted switch, 230VAC 50/60 Hz (installer/owner supplied). This switch is required to allow the SmartGlass panels to be turned ON/OFF. Alternatively a radio remote control switch can be specified.

**SmartGlass power transformer.** SmartGlass panels may be connected in parallel up to 4 square meters total area per single Tim 100 power conditioner/transformer. Bespoke electronic controllers can be used including “smart” systems such as Creston and ABX controllers.

**Note: Larger Power Conditioner / Transformers can be supplied to power larger areas of Smartglass, Contact us for further information.**

## INSTALLATION REQUIREMENTS

As with any electrical device, SmartGlass must be included in the electrical layout for each project. E.g. Position of spurs, switching layout, containment (conduit, trunking etc to house cables) connection boxes etc. The installation must meet all local rules and regulations. Also any metal frames which could come in to contact with the wiring of the panel must be earthed. Smartglass international is not responsible for these layouts however we can be contacted for further information.

## POWER TRANSFORMER / CONDITIONER DETAIL

Short circuit proof isolating encapsulated auto wound transformers for step down of 230V to either 110V or 65V depending on which film is used.

**WARNING: The transformer must be installed by the electrical contractor in an easily accessible area in order to replace fuse in the event of damage.**

### Specification: Tim 100 - Power Conditioner / Transformer.

Input Voltage	230V 50-60 Hz
Power	100 VA
Dimensions (L*W*H mm)	166mm * 77mm * 76mm
Weight	2.0 kg
Insulation	Double Insulated (No Earth Required).
Output voltage	Either 110V or 65V

- Twin secondary windings for series or parallel connection
- Integrated overload protection and short circuit proof
- Encapsulated in resin up to 300 VA
- Isolating transformer to IEC 61558-2-4, DIN EN 61558-2-4, VDE 0570 part 2-4

## WIRING

SmartGlass International requires that all SmartGlass electrical installations be completed by a licensed electrician, and in compliance with all local rules and regulations.

Before installation, inspect bus bars, electrode leads and wires to assure insulation. No exposed bus bars, electrode leads, or wires should contact any metal frames that will damage the transformer and SmartGlass. Any metal frames must be earthed.

Multiple SmartGlass panels should be connected in parallel with the transformer. Insure that the transformer "in" connects to 230V AC and "out" connects to SmartGlass panel. The output voltage is approximately 115V or 65V depending on the type of film used.

Before turning on the power, test resistance reading between the metal frame and electrode and make sure that the resistance reading is infinite. Otherwise, check short location and insulate electrodes from metal frames.

SmartGlass uses approximately 5 watts per square meter in the "on" (clear) state. No electricity is consumed in the "off" (opaque) state. SmartGlass can be controlled with either a single or multiple switches or by radio remote controller.

**NOTE: It is vital for correct operation that the switch/remote receiver is positioned on the mains voltage before the transformer/power conditioner. Failure to correctly install the switching mechanism may cause irreparable damage to the LC SmartGlass.**

Ensure the mains supply is switched off and take care when opening the power transformer, allow a few minutes to cool down. Internal electronic parts may be very hot, this is normal. Only open the power transformer in the areas noted safe for opening, never open the sealed body of the power transformer.

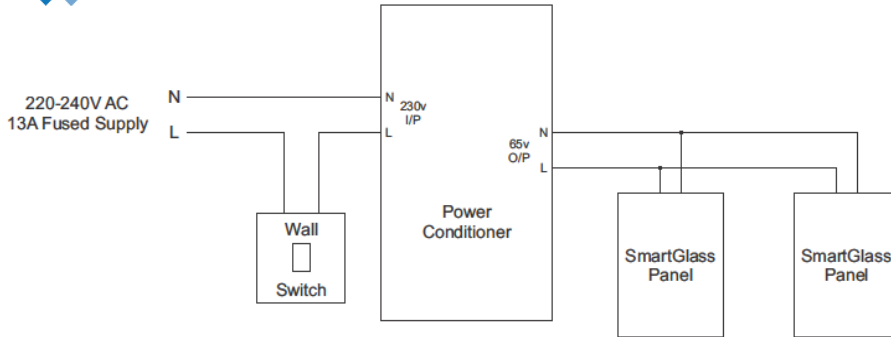
**Warning: Do not substitute a higher fuse rating! Fuse rating is critical to properly protect SmartGlass panels. A spare fuse is included on the inside cover of the power transformer supplied.**

## TYPICAL WIRING DIAGRAM



**SmartGlass International**

Standard Wiring Diagram 65V



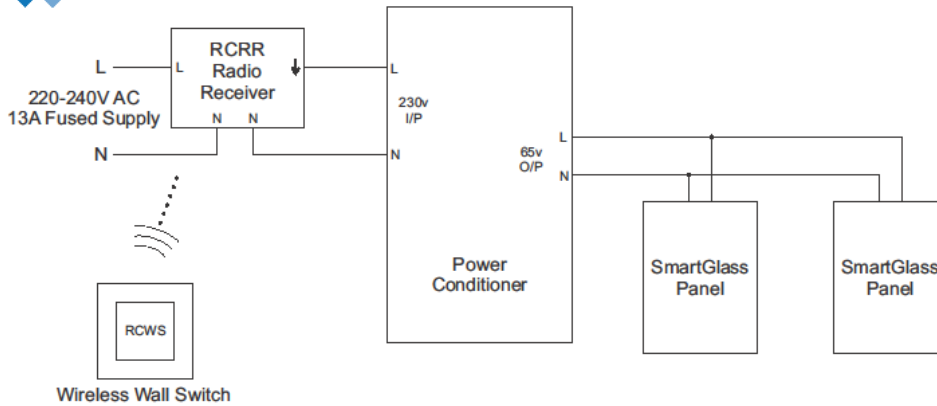
*Please Note: The Power Conditioner has a built in fuse and must be located in an accessible position*

Power Conditioner (230v AC to 65v AC 2x150VA) (223x117x117mm) 1 reqd per switchable area upto 12mSq



**SmartGlass International**

Wireless Wall Switch Wiring Diagram 65V



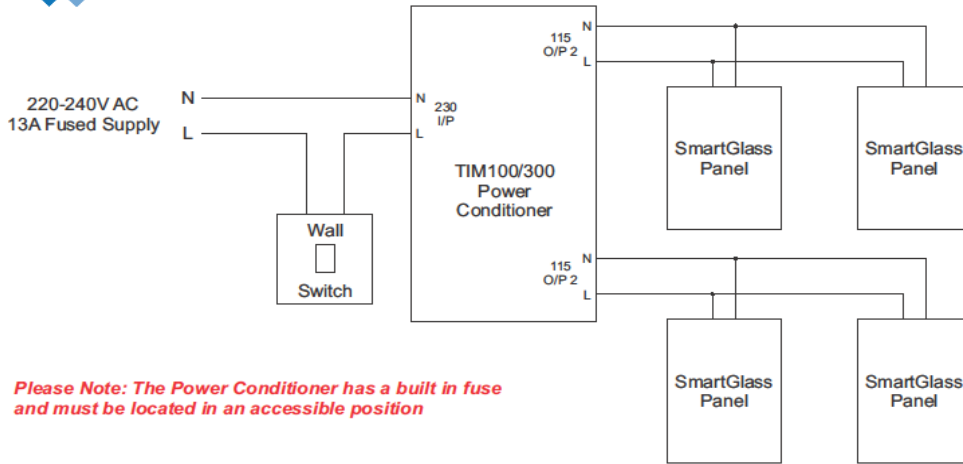
*Please Note: The Power Conditioner has a built in fuse and must be located in an accessible position*

Power Conditioner (230v AC to 65v AC 300VA) (223x117x117mm) 1 reqd per switchable area upto 12mSq



# SmartGlass International

## Standard Wiring Diagram



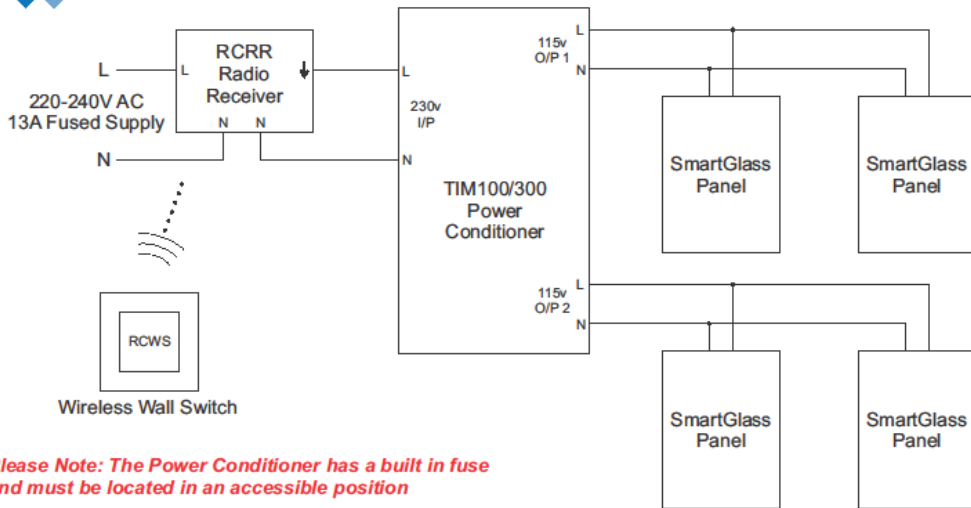
*Please Note: The Power Conditioner has a built in fuse and must be located in an accessible position*

TIM100 Power Conditioner (230v AC to 115v AC 2x50VA) (166x77x76mm) 1 reqd per switchable area upto 2x2mSq  
 TIM300 Power Conditioner (230v AC to 115v AC 2x150VA) (223x117x117mm) 1 reqd per switchable area upto 2x6mSq



# SmartGlass International

## Wireless Wall Switch Wiring Diagram



*Please Note: The Power Conditioner has a built in fuse and must be located in an accessible position*

TIM100 Power Conditioner (230v AC to 115v AC 2x50VA) (166x77x76mm) 1 reqd per switchable area upto 2x2mSq  
 TIM300 Power Conditioner (230v AC to 115v AC 2x150VA) (223x117x117mm) 1 reqd per switchable area upto 2x6mSq





### Remote Controls

868.3 MHz (CE Approved, License Free)

#### RCRR

86 x 76 X 63mm (excluding gland)  
Remote Control Receiver Relay  
Can be mounted out of site



#### RCWS

95 x 95 x 16mm  
Remote Control Wall Switch  
With Glass Surround



For more information please contact

Alan Saxby @ [a\\_saxby@smartglassinternational.com](mailto:a_saxby@smartglassinternational.com)

Website <http://www.smartglassinternational.com>

Mobile +44 (0)7515 163576

SmartGlass International Ltd. Unit 21, Cookstown Industrial Estate, Tallaght, Dublin 24. Ireland

VAT No: IE 642 6706T

Company Registration No: 406706

## MAINTENANCE

Maintenance is generally as simple as keeping the SmartGlass clean. Regular cleaning with **neutral** materials is recommended for optimum performance. In external windows soapy warm water performs best. Soft coated glass should be cleaned very carefully following the manufacturers own instructions. Use professional glass cleaner or a reputable cleaner.

**Annual checks:** The client should check that all wiring is in good condition, framing materials are free of any damage and that the transformer and switch are in good visible order. The areas adjoining the SmartGlass including walls, ceilings and floors should be checked for structural integrity, excess humidity and temperature. Should any of these items appear unusual the client should immediately notify the original supplier / installer / contractor or SmartGlass International.

## TROUBLE SHOOTING

LC SmartGlass operates at 110V or 65V AC and 50/60 Hz. Higher voltages and frequency may cause permanent damage.

Electrical service must be performed by a qualified electrician who has read and understood this document.

Switch the power ON. Verify that the SmartGlass panel switches. If one or more SmartGlass panels are not operating, check the following

1. Check the circuit breaker to verify power. If there is not power from the circuit breaker, reset or replace the circuit breaker.
2. Visually check the condition of all wiring and that connections have not been broken.
3. Check the switch to verify power. If there is no power from the wall switch check the connection or replace the switch.
4. Check input to the power transformer of affected panels to verify power. If there is not input power to the power transformer, check the wiring between the wall switch and the power transformer for damage and continuous current flow.
5. Check output from the power transformer of affected panels to verify power. If there is no output power from the transformer, the fuse may have blown. Replace fuse with the same size and specifications which is available at electronic supply shops such as RS. Each transformer contains a spare fuse inside the protective cover.

**If in any doubt, please contact us to resolve your issue.**

## CLIENTS (Selection)

End User	Application
The Royal Institution of Great Britain	Unveiling ceremony plaque
Etihad Airlines HQ Abu Dhabi	Executive offices & meeting rooms
Guinness Storehouse Dublin	Visitors Centre bespoke displays and windows
European Space Agency	Viewing rooms
Rolls Royce Marine	Company restaurant screens
Zain Telecom Bahrain	Executive offices & meeting rooms
Brinks Global	Security screens
Petrobras Brazil	Boardroom partition walls
Blackrock Clinic	Hospital Consultancy Room Screens
Central Bank of Ireland	Governors Suite and Meeting Rooms
Chevron Texaco UK HQ	Partition Systems board & Meeting rooms
Wellington Street Jazz Cafe	Toilet cubicle doors
Roseisle Maltings Whiskey Distillery	Feature visitor centre screens
Emirates Airlines	Chief executive office partition Dubai
Montreal Museum of Modern Arts	Feature display window
Nissan UK	Micra CC Launch, 140 panel display
Optica Opticians	Optical testing rooms
Saudi Aramco Oil	Office Partition Screens
Trinity College	Visitor centre feature wall
Royal College of Physicians	Privacy Doors
Saudi Arabia National Guard	Communications centre control suites
Stonecutter Court London	Conference Rooms
Old Jameson Distillery	Feature display / projection screen
Damico Tankers	Offices, meeting rooms and boardroom
Four seasons hotel	Room dividers
Trinity Yachts	Yacht internal screens
Goldbach Kirchner	Bank boardroom
Top Gear Live Shows - Prototype Tour	Glass car - performed stunts at Top Gear live show
Royal Sunderland Hospital	Doors/Screens for ICCU ward
ITV Daybreak Studios	Glass backdrop in tv studio
Kempinski Hotel Bahrain	Bedroom/En-Suite privacy screens
National Health Service	NHS Innovation centre screens

## TESTIMONIALS (Selection)

“We recently opened our brand new flagship clinic in Marylebone Village London. We decided to create a wall and door out of SmartGlass leading in to our Skin Experience room. The result is beautiful and clients have been really impressed. At night we open the glass and have the room all lit up and it has turned out to be an amazing feature in our clinic.”

[Theresa Candolo – Salon Manager, Skin Health Spa Marylebone London.](#)

“Top Gear Live has a reputation for pushing the boundaries of car theatre and each new tour requires incredible technology, passion and dedication to deliver the spectacle our audiences have come to expect. For the 2010/11 Prototype Tour I needed a company who could help me make a car turn from solid to transparent at a touch of a button. SmartGlass International were a great partner working meticulously with me to develop the car panels required for this unique hyper car and proved to be the perfect solution to a problem no one thought they'd ever have; how do I turn my car see through?”

[Rowland French – Top Gear Live Shows](#)

“From ordering to installation everything went smoothly. The finished room divider has added a new dimension to our working environment making the office seem much more spacious (replacing a wall) and giving privacy when required”

[Martin Travis – Symbolic & Chase](#)

“We at Kentish Town Sports Centre have found the installation of Smart Glass to have been of great benefit to the service we provide to our many and varied customers. We run ‘women only’ swimming sessions for religious reasons or for other privacy issues and this means that we can have our pool in ‘privacy’ mode or ‘open’ mode for when the pool is being used for children’s swimming lessons when parents like to observe from a distance. We have had no maintenance issues with this facility and would recommend this product to anyone in a similar circumstance to ourselves”

[Grant McCahon – Kentish Town Sports Centre](#)

“I’m very pleased with how the SmartGlass turned out, it was well worth the investment and continues to impress me”

[Michael Linnit – Chatto & Linnit Ltd.](#)

“I was thoroughly impressed by the funky, cool smart glass bathroom. I have never seen this type of glass before and it still impresses me even now. I enjoy showing guests the smart glass and seeing their genuinely positive reaction. The smart glass adds a lot of fun to guests stays!!”

[Kym Hammond – Reception Manager, The BrewHouse Hotel](#)

“The SmartGlass is a 'wow' factor for visitors and should help us materially improve business this year. It is used in a very prominent area and is a real talking point. To be honest it is also extremely practical. It is great to have it on most of the time to give the view and light and then frost it up for private meetings.” - [Gerald Maloney - Managing Partner GJ Maloney Solicitors](#)

“The SmartGlass allows my team of care staff to effectively review patients safely and conveniently. This is a wonderful innovation that allows critically ill patients a high level of safety during their hospital stay.”

[David Mc Nicholas, Sunderland ICCU Manager](#)

## CASE STUDIES (SELECTION)

### A Smart solution for Swords Central...

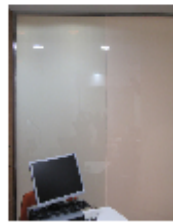


Swords Central Post Office opened in The Pavilions shopping centre in Swords Co. Dublin on November 1<sup>st</sup> 2010. This state of the art development is 2,500 square feet with a mezzanine of a further 1,100 square feet and offers a new and improved customer experience. The new facility will greatly enhance the service on offer to businesses and the general public in the local and broader community in Swords, North Dublin.

Privacy glass for a management office was specified as part of the projects initial design brief. This was chosen to allow management to view the shop floor instantly to monitor operating activity. This glass would also ensure safety measures from a security perspective where the back of house area is protected from the shop floor using a toughened security glass screen.



Switched On



Switched Off

SmartGlass International provided the ultimate solution to these design requirements with its LC SmartGlass. LC SmartGlass offers instant privacy at the flick of a switch. Using a minute electrical current, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa.

All LC SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a PDLC film between 2 or more glass sheets. Two large LC SmartGlass panels were used to create the switchable security glass screen as can be seen in the imagery above.

The management office is located behind the screen and situated in the corner of the floor space beside a number of "service zones". These service zones will offer financial and insurance services where customers can sit down with a member of staff to discuss plans and packages.

Constant monitoring of this area is essential to allow management observe customer footfall and ensure that the very best customer service is being delivered to each and every patron by ensuring over crowding does not occur within these zones.

LC SmartGlass above all provides a sleek and sophisticated look creating an attractive corporate interior while at the same time offering an exceptionally practical function.

SmartGlass International is delighted to work with one of Irelands largest and most recognised companies on such a state of the art facility.



Switched On



Switched Off

Contact us: [info@smartglassinternational.com](mailto:info@smartglassinternational.com)  
[www.smartglassinternational.com](http://www.smartglassinternational.com)



SmartGlass International

THE  
BREW HOUSE  
HOTEL



## SmartGlass goes boutique chic...

The Brew House Hotel, located in the historic Pantiles area of Tunbridge wells, is a luxurious boutique hotel and stylish destination for travellers the world over. Designed to a superior standard, the Brew House hotel blends contemporary modern style with imaginative lighting and comfortable furnishings. With a total of just fifteen rooms, the design team at the Brew House Hotel bestowed special care and attention to each room creating a modern and sophisticated state of the art space which is both functional and elegant.

### SmartGlass International

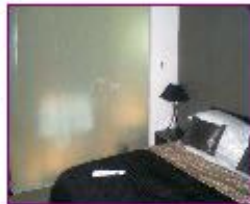
SmartGlass International specialise in the hospitality, commercial and healthcare sectors providing switchable glass solutions to an extensive selection of projects small and large across the globe.

Privacy control glass was specified in the design brief when the hotel was at planning stage where the en-suite could be separated from the bedroom instantly. With elegance and sophistication at the forefront of the design brief, a sleek and stylish interior was required which could also serve the functional purpose of instant privacy control.

SmartGlass International, the leading worldwide manufacturer of electronically switchable glass would be the solution to this design task.



Switched On



Switched Off

### LC SmartGlass

LC SmartGlass offers privacy on demand at the flick of a switch matching the criteria of the design brief entirely. This modern design feature precisely matches the image that the Brew House wishes to portray; a chic boutique stylish destination.

All LC SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a PDLC film between 2 or more glass sheets. Using a minute electrical current, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa.

### How does it work?

When the electrical supply is switched on, the liquid crystal molecules align and incident light passes through and the LC SmartGlass panel instantly clears.

When the power is switched off the liquid crystal molecules are randomly oriented scattering light and the LC SmartGlass becomes opaque (private).

### The Brew House Hotel

LC SmartGlass is an easily cleaned, low maintenance surface which is ideal for application in the hotel environment. The SmartGlass not alone serves as a privacy screen but also features as a unique/exciting gadget for guests to enjoy.

The privacy screen in each en-suite room is comprised of five LC glass panels fitted together using a clear silicone joint to create a smooth glossy surface. The glass can be changed from clear to opaque using a wall switch which is located inside the bathroom area.

The Brew House Hotel has received some outstanding reviews on travel review website TripAdvisor.co.uk; "The bathroom was lovely especially the SmartGlass which when activated by a switch turned the glass frosty, a nice touch", "The bathrooms were a marvel, from the SmartGlass to the flooring of the shower".

SmartGlass International is delighted to have worked on such a superb project in such a fantastic location.



### Contact us

Email: [info@smartglassinternational.com](mailto:info@smartglassinternational.com)

Web: [www.smartglassinternational.com](http://www.smartglassinternational.com)



## SmartGlass International “tunes in” to ITV Daybreak...

Daybreak is the weekday breakfast television programme broadcast from 6:00am to 8:30am for the British commercial ITV network anchored by Adrian Chiles and Christine Bleakley.

Daybreak took to the air on Monday 6<sup>th</sup> September as the much-heralded replacement for breakfast TV show GMTV. More than one million people tuned in to see the launch of ITV's new breakfast show - an improvement over its predecessor, GMTV. ITV said the show, which featured an interview with former Prime Minister Tony Blair, peaked at 1.5m viewers. ITV are one of the UK's largest broadcasting stations and reach approximately 13 million viewers a week with Daybreak regularly accounting for a large proportion of this.

The Daybreak studio is located in the heart of London at South Bank studios. The London City skyline is the backdrop to the Daybreak studio offering an unrivalled view across the city from St. Paul's Cathedral right across to the Gherkin.



### SmartGlass International

SmartGlass International's SPD SmartGlass was specified for this state of the art television studio project to create a solar control glazing system that would combat the negative effects of direct sunlight including glare and heat.

SPD SmartGlass is the latest innovation from SmartGlass International and is the ideal solution for a project of this type precisely meeting the design brief.

SPD SmartGlass offers the perfect solution and is installed in approximately 100 panels throughout the studio. The glass facade can be automatically dimmed from clear to dark controlling glare and solar heat gain while protecting the studio inhabitants from the damaging effects of UV.

### SPD SmartGlass

SPD-SmartGlass can be manually or automatically “tuned” to precisely control the amount of light, glare and heat passing through a window. While glass is a favored product for use in building facades; glare, solar heat gain and UV exposure are problematic and can often make the use of glass impractical resulting in the need to invest in expensive solar shading devices.

Glass facades using patented SPD light-control technology reduce the need for air conditioning during the summer months and heating during winter.

## Daybreak



The ability to instantly switch the glass to maximize daylight when it's really needed and to provide controllable solar shading during peak light conditions is valuable and unique. This feature is especially useful for application in a television studio as it allows for maximum daylight to enter without compromising recording quality and controls room temperature which is also critical in this particular environment.

Daybreak is broadcast from dawn meaning the levels of sunlight entering the studio vary throughout the morning. When the sun is just rising over London the backdrop is in darkness, at this stage the glass is at its clearest state where it will allow for maximum light penetration. As the morning gets brighter, the glass is “tuned” to control glare from the sun and heat passing through into the studio.

### Principle

All SPD SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a SPD “Suspended Particle Device” film between 2 or more glass sheets.

When the power supply is switched on, the rod shaped suspended particle molecules align, light passes through and the SPD SmartGlass panel clears. SPD SmartGlass protects from damaging UV when on or off.

When the power supply is switched off, the rod shaped suspended particle molecules are randomly oriented blocking light and the SPD SmartGlass becomes dark blocking up to 99.4% of light.



SPD SmartGlass has lots of advantages supplementary to what is listed above including energy savings on cooling and light costs, reduction of buildings carbon emissions and elimination of the need for expensive window dressings. SmartGlass International is delighted to work on such a state of the art project where innovation and design are at the forefront.

### Contact us

Email: [info@smartglassinternational.com](mailto:info@smartglassinternational.com)  
Web: [www.smartglassinternational.com](http://www.smartglassinternational.com)



Smartglass medical

City Hospitals Sunderland   
NHS Foundation Trust

In times of heightened awareness surrounding HCAI's across the healthcare sector, it is essential that hospital venues be fitted with the correct professional solutions to provide piece of mind and protection to the people within this environment.

With the ever increasing threat of in-house infection, it is crucial that an answer be provided to combat this hazardous dilemma.

This was promptly recognised by the Royal Sunderland Hospital, which in turn was reflected throughout their project brief with superior healthcare standards at the forefront of every design consideration.



### Project Brief

Extension of the Royal Sunderland Hospital to increase patient capacity from 970 to 1108.

A 138 bed ward extension to provide much needed supplementary care facilities for the hospital. This state of the art Integrated Critical Care Unit (ICCU) separates theatre staff and nursing staff to eradicate the chances of contamination spreading between the two sections.

The primary motive for this project brief is a new scheme being employed by the NHS Foundation Trust throughout the UK, Royal Sunderland Hospital being the first to recognise and develop the new initiative.

SmartGlass Medical specialize in this field where ordinary interior settings are transformed into modern, state of the art settings while at the same time offering a unique environment in which patient care and wellbeing is at the forefront.

### Contact Information:

Website: [www.smartglassmedical.com](http://www.smartglassmedical.com)

Email: [info@smartglassmedical.com](mailto:info@smartglassmedical.com)

LC SmartGlass™ offers instant privacy at the flick of a switch. Offering patient dignity and privacy while allowing hospital staff to safely and efficiently review patient well being the SmartGlass screen offers a sheer easily cleaned surface to replace traditional blind systems which are difficult to clean and are high risk in terms of harboring dirt and bacteria. LC SmartGlass can be tailored to suit varying healthcare applications with requirements such as fire rated, x-ray proof and impact resistant glass.

All LC SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a PDLC film between 2 or more glass sheets. Using a minute electrical current, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa.

### Principle

When the electrical supply is switched on, the liquid crystal molecules align and incident light passes through and the LC SmartGlass panel instantly clears. When the power is switched off the liquid crystal molecules are randomly oriented scattering light and the LC SmartGlass becomes opaque (private).

### Royal Sunderland Hospital

The Integrated Critical Care Unit (ICCU) includes high-dependency single bed units, isolation single bed units and general post-operation single bed units. In such a delicate environment, extra care must be taken to protect those who are most vulnerable to infection, patients and healthcare personnel. For this reason, state of the art partitioning was required to live up to the health and safety requirements of these particular divisions within the ICCU.



Switched On



Switched Off

LC SmartGlass toughened panels were used to create a state of the art partitioning system along the corridors of the ICCU. The double doors entering each ward are fitted with LC SmartGlass toughened door panels allowing for patient privacy and dignity at the flick of a switch, while also permitting care staff to effectively monitor patient activity.





## SmartGlass drives in Top Gear...

Top Gear Live is a live arena show of the award winning TV program Top Gear. The live show features breath-taking stunts, remarkable special effects and epic driving sequences. The live show is home to an array of pyrotechnics, a bombardment of noise and a spectacle of motoring.

A collection of the finest cars from all over the globe grace the arena floor. Jeremy Clarkson, Richard Hammond and James May host the live show with their cheeky approach to motoring and humour whilst some of the world's best precision drivers perform awe-inspiring stunts live in the arena.

"This show is like nothing we have done before. It will have some very special, special effects," Jeremy Clarkson.

Ever since it made its live debut on the World Stage in 2008 Top Gear Live has been seen by over 1,000,000 fans and is continuing to push the boundaries of car theatre.

### Top Gear Live 2010

For the 2010 show, Top Gear producers wanted to create the ultimate car to star in the finale of the live show. After much debate regarding model, materials, specifications etc. they decided on an almost impossible concept.

"A car will come out and become invisible" Richard Hammond.



The producers were faced with a problem. How would they design a car which could change state instantly and give this magnificent illusion? What type of materials would allow them to create this?

It was decided that a switchable glass would be used to make up the bodywork of the car which could switch on and off simultaneously giving the effect of changing visible/invisible states.

The interior of the car was visible when in its clear state showing the famous "Stig" and his female sidekick; when the glass switched to its "invisible" state the passengers could not be seen.



### SmartGlass International

SmartGlass International was approached to quote this project at the early design stages and to investigate whether the concept would be viable.

SmartGlass International is the leading worldwide manufacturer of electronically switchable glass and provides the perfect solution to this design problem. SmartGlass can be used in almost every glazing application as it is available in a number of different shapes and can also be curved making it suitable for a range of different applications specializing in the hospitality, healthcare and commercial sectors.

### LC SmartGlass

LC SmartGlass is one of the trademarked electrochromatic glass products available from SmartGlass International.

LC SmartGlass panels are bespoke manufactured using a lamination process which encapsulates a PDLC film between 2 or more glass sheets. When a minute electrical current is activated, users can immediately switch the LC SmartGlass from clear to private (opaque) and vice versa precisely meeting the proposed design brief.

In this case, polycarbonate replaced traditional glass to make up the panels. The panel sizes were much smaller for this application than usual and required much more detailed wiring so that each individual panel would switch at the exact same time on the car. Another design problem would be the convertible roof feature which would be manufactured entirely of SmartGlass.

This was a challenge for the SmartGlass team, but through careful testing of the materials they found the ideal solution. The panels would be aligned and connected in such a way to allow the roof to lift up without the connection being lost so that the panels would switch simultaneously during this particular action scene of the show where the roof rises up to release a passenger from the car. A similar system is used when fitting SmartGlass panels into a folding door system.



SmartGlass International is thrilled to work on such a remarkable and exciting project.

Visit SmartGlass International online to view all of the latest projects and subscribe to the monthly SmartGlass newsletter.

Contact us: [info@smartglassinternational.com](mailto:info@smartglassinternational.com)  
[www.smartglassinternational.com](http://www.smartglassinternational.com)

# PROJECT PICTURES



Elm Park Marketing Suite



Manor House, Roof-light



Blue Sun World Sales Office



Royal Institute of Great Britain



Woodford HQ Boardroom



Meeting room, Bank HQ. Courtesy SCHOTT Glass & Golbach Kirchner Germany



An Post central post office, Swords, Dublin

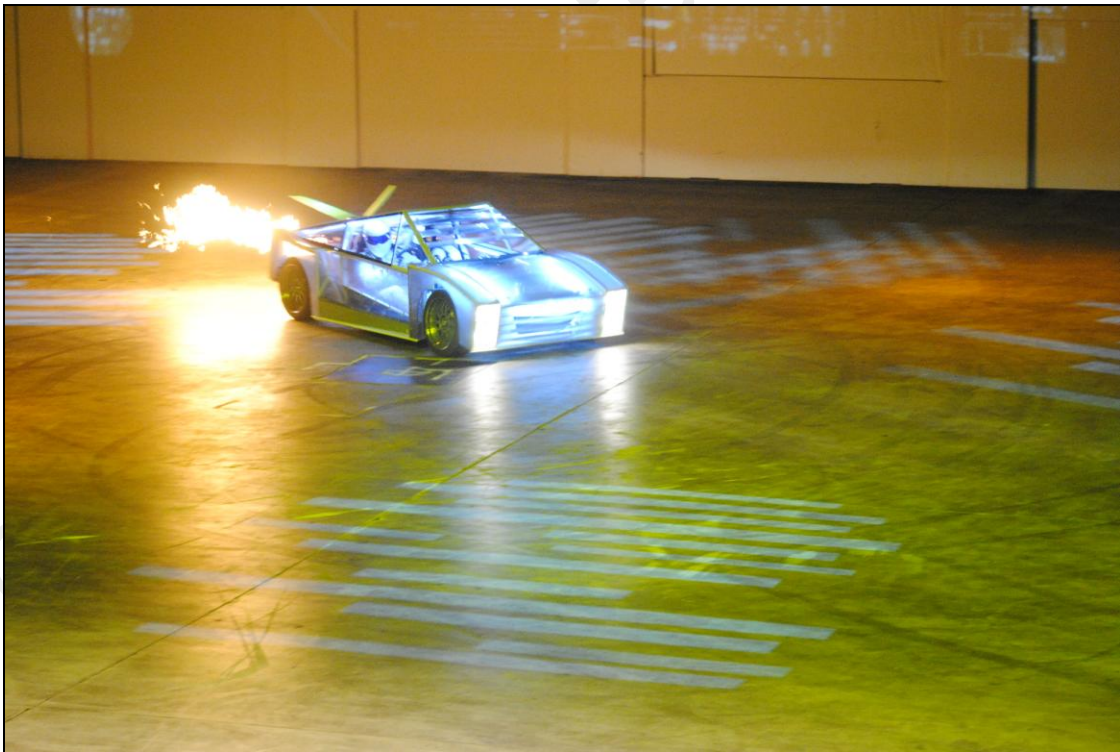




Brewhouse hotel, Tunbridge Wells, Kent, England



Daybreak TV set London



Top Gear festival. Worldwide

# SmartGlass International™ Ltd

## Terms & Conditions of Sale

1. **Price** - All quotations are subject to confirmation in writing by the Company on receipt of the order and deposit from the Purchaser.
2. **Delivery** - Time of delivery shall not be the essence of the contract, nor shall the Purchaser have the right to make it such. Whilst every endeavour will be made to adhere to any quoted or agreed delivery date or programme, the Company shall in no circumstances be liable for any costs due to delay in delivery, whether due to shortages of material, labour or any other cause whatsoever.
3. **Payments** - Shall be made at the time specified. The amount of the order value to be paid will be that specified in the face of the contract or calculated in accordance with the formula therein. The amount shall not be subject to any discount or set off whatsoever except with prior agreement in writing by the Company. Payments not received within 30 days from date of invoice will be subject to the additional charges as set out in the European Communities "Late payment in commercial actions" regulations 2002.
4. In the case of goods exported, or sent by independent freight carrier whether arranged by the Company, or others, the Purchaser agrees to comply in all respects, with the freight carrier's conditions of carriage for notification of claims, loss or damage in transit.
5. **Insurance** - It is the responsibility of the Purchaser to insure goods in transit and to pay any costs to the Company for arranging such insurance.
6. **Certificate of Conformity** - The Company shall not supply certificates of conformity unless requested at the time of placing the order. The company reserves the right to charge a fee for any certification supplied.
7. **Retention of Title**
  - (1) The goods shall be at the Purchasers risk from the time of delivery or collection.
  - (2) In spite of delivery being made, property in the goods shall not pass from the Company to the Purchaser until the full contract value has been paid the full, inclusive of vat where applicable.
  - (3) Until property in the goods passes to the Purchaser in accordance with clause (2) the Purchaser shall hold the goods and each of them on a fiduciary basis as bailee for the company.
  - (4) Until such time as property in the goods passes from the Company, the Purchaser shall, upon request, deliver up such of the goods as have not ceased to be in existence or resold, to the Company. If the Purchaser fails to do so, the Company may enter upon any premises owned, occupied or controlled by the Purchaser, where the goods are situated, and repossess the goods.
  - (5) The purchaser shall promptly deliver the prescribed particulars of this contract to the Registrar in accordance with the companies act. Without prejudice to the other rights of the Company, if the Purchaser fails to do so all sums whatever owing to the Purchaser the Company shall forthwith become due and payable.
8. **Jurisdiction** - The Purchaser accepts that any claim in respect of this or any contract, claim or action with the Company, shall be governed by the jurisdiction of the Irish and English Courts.
9. The Purchaser agrees that these conditions of sale shall bind any subsequent orders and business with the Company unless expressly excluded or varied in writing by the Company.
10. No liability will be accepted by the Company for damage to free issue glass or other materials supplied by the customer for lamination.
11. SmartGlass will be sold of merchantable quality, fit for purpose and as described. Caveat emptor, the purchaser is responsible for ensuring that the goods they are purchasing are the goods that they expect to receive. It should be noted that there will always be an element of haze within the SmartGlass. This will not be considered or constitute reason for return or refund.
12. If for any reason the materials supplied develop a fault within the warranty period which is considered to be due to bad workmanship or material faults, Smartglass international Limited will repair or replace at their discretion, such items to the original supply specification. Smartglass International will not be held responsible or accept any costs incurred by others which are associated with access, removal or replacement of the goods.
13. The SmartGlass Handbook which is available upon request from our office, or available for viewing on our web-site, should always be reviewed by the customer for specific instructions on the products.
14. Visual inclusions will only be considered as defects when visible from a distance of equal to or greater than 3 meters from the glass surface.
15. A bending/bowing tolerance of up to 3mm per meter in glass length is within tolerance and will not be considered as defective.

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