

Glass guide

Choosing the right glass

Today's glass and window units have become so advanced that in addition to basic functions such as offering protection against weather, daylight and unwanted views, they also protect against fire, noise, sunlight and much more.

Standard units

Unit structure

Double glazing units are made up of two pieces of glass with a spacer.

The definition 4-15-4 means that the double glazing unit consists of a 4mm pane, a 15mm spacer and a 4mm pane. The first pane of glass is defined as glass layer 1 and is the exterior pane of glass, while the other pane is glass layer 2 and therefore the interior pane of glass (it follows that a three-layer triple glazing unit will have a third layer of glass).

Varying the thickness and number of panes, the width of the spacer, the types of coating/laminates and the type of air/gas in the cavity allows you to adjust the function of the glass. This makes it possible to create different types of glass which meet a variety of needs. It is also possible to combine specific features to create several functions in one unit.

Energy units

The heat loss from the building to the external environment has a significant impact on energy consumption making the insulation properties of the units important. The insulation properties of a unit are described as its Ug-value.

Energy units offer good insulation properties and excellent light transmission. Energy units improve the indoor climate by reducing cold down-draughts and cold radiation which minimises the need for heating and contributes to reduced heating bills and a better environment.

Warm edge

The distance between the two panes of glass in an energy unit is secured by a spacer. Spacers are usually made of aluminium or steel which produces an unwanted thermal bridge at the edge of the glass. EA A/S now introduces a warm edge design with a spacer made from a thermoplastic material.

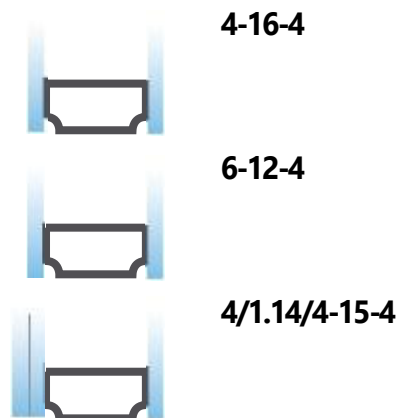
The warm edge reduces the thermal bridge at the edge of the glass. This helps cut the total heat loss of the window, expressed as the Uw-value, which benefits both the environment and the heating bill. Using warm edge also raises the temperature along the edge of the glass which reduces the risk of internal condensation.

Improved look

The dark edge of the warm edge spacer gives the window a more harmonious look and eliminates much of the light reflection in the windows created by the shiny surface of steel spacers

Outside

Inside



Abbreviations

Ug-value – Insulation property

The Ug-value is measured in the centre of the unit and is referred to as the centre point value.
The value is stated as: W/m^2K (Watt per $m^2 \times$ Kelvin).
A low figure means that the unit offers good protection against heat loss.

LT-value – Light transmission

The value is stated in percent expressing the amount of light which is admitted through the glass.
A high figure indicates a high degree of light transmission.

g-value - TST

(Total Solar Energy Transmittance or Solar Energy Transmission)

The value is stated in percent expressing the amount of solar energy (thermal energy) which is admitted through the glass.
A high figure indicates a large admittance of solar energy.

LRout - Outward light reflection

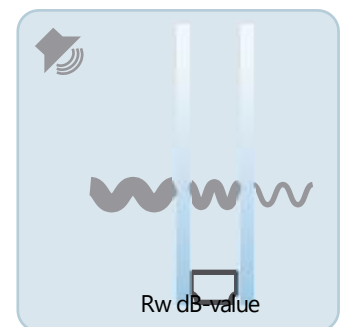
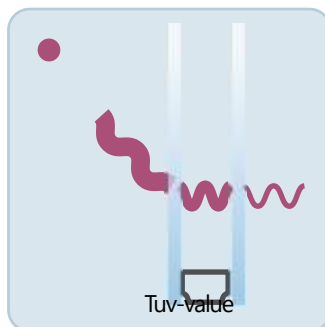
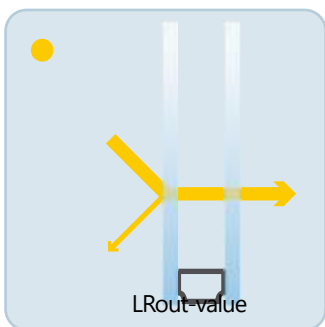
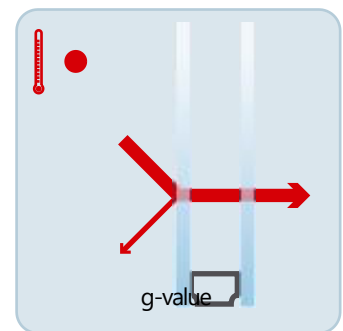
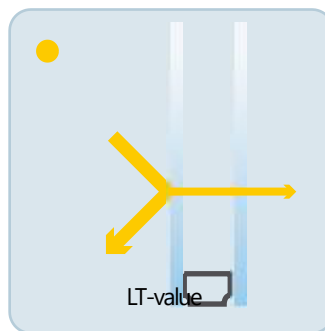
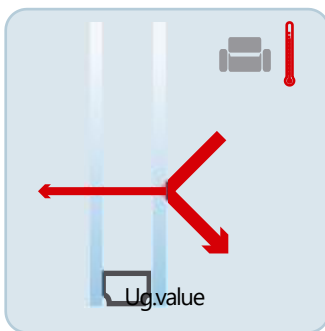
Reflection is stated in percent as the part of the light which is reflected outward. (For comparison inward reflection is stated as LRin)
A high figure indicates major reflection when viewed from outside.

Tuv- Transmission of ultraviolet radiation

Transmission is stated in percent as the part of the sun's ultraviolet rays which is admitted through the glass.
A low figure indicates that the uv-rays have a low impact on objects inside the building which minimises fading.

Rw dB – Sound reduction

Reduction is stated in decibel and describes the glass' ability to reduce discomfoting noise.
A high figure indicates a high degree of sound reduction. The figure is not calculated as a percentage reduction, but as a fixed figure in relation to the structure of the unit.



Solar reflective glass

Solar reflective glass reduces the amount of thermal energy and/or light which is admitted through the unit. This type of glass is often used for large surfaces where the aim is to make full use of the sunlight while at the same time keeping out the solar heat. In other cases both the sun and the heat is kept out.

The g-value is the amount of the sun's thermal energy which the glass allows to pass into a room. The transmission of daylight is called the LT-value.

Solar reflective glass is available in a variety of options; colour neutral, coloured and with various degrees of reflection. All these factors determine the amount of light and heat which is admitted through the glass. If you choose solar reflective glass for aesthetic reasons the design is entirely up to you. In all other cases it depends on how highly you value low solar energy transmission in relation to high light admittance.

Facts

Solar reflective glass absorbs a lot of solar energy. This is why the glass is toughened to eliminate the risk of thermal fractures.



Acoustic insulating glass

Acoustic insulating glass reduces uncomfortable noise from heavy traffic and regular city noise. It is the distance between the unit's individual glass panes and the panes' individual thickness that helps define the unit's acoustic insulating properties.

When selecting the right type of acoustic glass, it is important to determine the source of the noise you want to reduce.

The acoustic insulation of the unit is stated in decibel, R_w , as a sound reduction figure. The figure indicates by how many decibel the unit reduces external noise – depending on the source of the noise. It is also important to keep in mind that R_w is a weighted value representing the entire sound frequency spectrum. Different sounds represent different frequencies in the spectrum. The R_w -value is consequently a mere base for the calculation of the actual reduction of any given noise.

Facts

The thicker the glass, the better the sound reduction
Glass of various thicknesses boosts sound reduction
The larger the distance between the panes, the better the sound reduction

Here are some examples of noise levels:

Whisper	30 dB
Speech	40-60 dB
Vacuum cleaner	65-75 dB
Car	70-80 dB
Truck	80-90 dB
Air hammer drill	90-110 dB
Jet plane	110-130 dB

Safety glass

Safety glass

Personal safety

Safety glass is intended to prevent or minimise the risk of injury in case of human impact.

In places where people can come into contact with both sides of the pane through accidental impact, the requirement for safety glass extends to both layers of glass.

Safety glass is available as laminated and toughened glass both providing increased impact protection.

The plastic film in laminated glass holds the glass pieces together thus preventing serious injury.

When toughened glass breaks, it shatters into many small blunt pieces which reduces the risk of serious injury.

Laminated glass

Laminated glass is a combination of two or more layers of glass with an interlayer of plastic film. The glass is heated until the plastic film melts and bonds with the glass forming a transparent pane.

Toughened glass

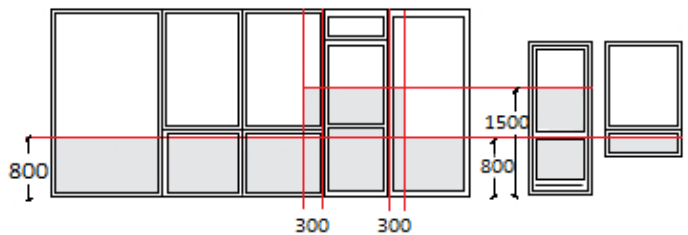
Toughened glass is heated to very high temperatures creating compressive stress in the surface of the glass. The treatment makes the glass able to withstand severe impacts such as kicking or people tripping and hitting the glass.

Facts

Always choose personal safety glass if part of the unit is placed less than 1.50 metres above the floor in doors and door side-lights and access points.

The same applies to other risk areas where the unit is placed less than 0.8 metres above a particular surface.

Guidelines for safety glass are described in BS 6206:1981 and BS 6262-4:1994.



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Security glass

Burglary and vandalism

Security glass is intended to prevent or delay passage through the unit following a physical attack.

Security glass can offer protection against vandalism committed using objects such as hammers, axes and bricks or falling material, against planned intrusion (such as burglary) and against gunfire attacks (bullet-proof glass).

Security glass is made from laminated glass or glass which is both laminated and toughened.

Whether you should choose laminated security glass or security glass which is both laminated and toughened depends on what the glass should protect against and how effective the protection should be. The thickness and number of glass panes as well as the type of film used determine the resistance of the security glass. Several layers of glass with a thicker film provide higher breaking resistance

Facts

The requirements for security glass are always equal to laminated glass. The thicker the glass and film and the more layers, the more effective the protection.

Security glass against manual attack is classified in accordance with BS EN 356:2002

Security glass against bullet attack is classified in accordance with BS EN 1063:2000.



Facade glass

Facade glass for spandrels is used for various purposes on large external surfaces. It can also be used between floors and on surfaces where a blocking of the view is required.

EA A/S can supply facade glass as single glazing units or as double glazing units for spandrels.

Facade glass can be divided into three visual functions:

- Matching facades
- Look-a-like facades
- Contrast facades

Matching facades, if you want a calm and harmonious relationship with facade materials such as windows and spandrels. Usually enamelled or silk-printed glass is used.

Look-a-like facades, if you want optimum similarity in the reflection of facade glass and double glazing units. Coated glass types are normally used for these types of facades.

Contrast facades, if you want to create a contrast between facade glass and double glazing units. This can be done using coloured glass in various combinations of colour for a mosaic effect. Enamelled glass is typically used here.

Facts

“Look-a-like” facades

In order to produce reflection, the area behind the glass must be darker than the area in front of the glass.

The greater the difference in light on the inside/outside, the greater the reflection in the windows.

Look-a-like therefor occurs in the daytime – in the evening light conditions change and the reflection is reduced or disappears.



Units with integrated blind

Units with integrated blind are a combination of a double glazing unit and a Venetian blind.

The blind is sandwiched between two layers of glass and is isolated from the inside as well as the outside environment. The blind is operated by a single cord which both turns the strips and draws them up and down, depending on the type of blind.

The blind provides effective protection against solar heat. If kept shut completely, it works just like the third layer of a triple glazing unit.

Units with integrated blinds also have the advantage of being able to partially or completely block unwanted views whenever desired.

The blind requires no cleaning, is hygienic and suitable for use in for instance hospitals and surgeries.

It also saves energy for heating, air conditioning and maintenance/repairs of an external or internal blind.

Facts

- Shields against sunlight
- Shields against heat
- No cleaning
- Saves energy for heating and air-conditioning



Fire protective glass

Fire protective glass must provide efficient protection against flames and fumes. Certain types of fire protective glass can also reduce or stop the direct radiation heat and provide effective insulation. EA A/S' fire protective glass can do just that.

The more layers of fire protective material, the longer it takes for the fire to penetrate the glass and the slower the rise in temperature on the other side of the glass. This is why it is a good idea to choose fire protective glass with at least three interlayers of protective material. Particularly for situations where radiation heat may set material on the other side of the glass on fire, or in situations where you want to secure an escape route.



The fire penetration time is directly proportional to the number of fire protective interlayers.

Reducing radiation heat prolongs the clearance period, minimises the spread of the fire and the cost of fire damage.

Fire protective glass is classified in accordance with BS EN 357:2001.

The total glass/window structure, i.e. the glass, the glass fitting method, the frame/sash design and mounting system must be approved by proper authorities in order to meet the classification requirements in the various fire classes.

Clear demands on function

When choosing the right type of glass you will probably have to consider many – and perhaps even conflicting – requirements and wishes.

The most common requirements are for:

- A low Ug-value, as it provides good insulation, reduced energy consumption and a high surface temperature resulting in less cold down-draughts and cold radiation.
- Light transmission which is defined according to the need for admitting a lot of daylight or for keeping it out. You may either want a very natural light which also reduces the cost of artificial lighting or you may want to prevent reflections in for instance computer screens.
- Solar energy transmission which is defined according to the need for a high thermal energy admittance versus a low thermal energy admittance. A high thermal energy admittance reduces heating costs while a low thermal energy admittance prevents for instance large offices from becoming too hot and also reduces air-conditioning costs.

Preferably, a window solution should be able to satisfy all three requirements, with the highest values possible while at the same time considering the reflection, colour and appearance of the pane.

The checklist can give you an idea of your options and the requirements you may have for the glass when choosing a window.

Define:

- Insulation properties, Ug-value
- Light transmission, LT-value
- Solar energy transmission, g-value

- Fire protection
- Noise control
- Personal safety
- Security class

- Aesthetics



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Tables

Energy units

Glazing	Composition	Dim.	Gas	Ugvalue	LT%	g %	LRout%	Rw(C;Ctr)dB
ICLow-E	4-16-4 (S3)	24	Argon	1,13	80	61	13	29 (-1;-4)
ICLow-E	6-14-4 (S3)	24	Argon	1,2	79	59	13	35 (-1;-5)
ICLow-E	6-12-6 (S3)	24	Argon	1,3	78	59	13	31 (-1;-4)
ICLow-E	8-12-4 (S3)	24	Argon	1,3	78	57	12	36 (-2;-5)
ICLow-E	4-20-4 (S3)	28	Argon	1,15	80	61	13	*
ICLow-E	6-18-4 (S3)	28	Argon	1,1	79	59	13	36 (-2;-5)
ICLow-E	6-16-6 (S3)	28	Argon	1,1	78	59	13	31 (-1;-4)
ICLow-E	8-16-4 (S3)	28	Argon	1,1	78	57	12	37 (-2;-6)
ICLow-E	4-22-4 (S3)	30	Argon	1,2	79	61	13	*
ICLow-E	6-20-4 (S3)	30	Argon	1,1	79	59	13	37 (-1;-5)
ICLow-E	6-18-6 (S3)	30	Argon	1,1	78	59	13	*
ICLow-E	8-18-4 (S3)	30	Argon	1,1	77	57	12	*
ICLow-E	4-24-4 (S3)	32	Argon	1,17	80	61	13	*
ICLow-E	6-22-4 (S3)	32	Argon	1,2	79	59	13	*
ICLow-E	6-20-6 (S3)	32	Argon	1,1	78	59	13	*
ICLow-E	8-20-4 (S3)	32	Argon	1,1	78	57	12	37 (-3;-7)
ICLow-E	4-10-4-10-4 (2xS3)	32	Argon	0,8	71	50	18	*
ICLow-E	4-10-4-10-4 (2xS3)	32	Krypton	0,6	71	50	18	*
ICLow-E	6-24-6 (S3)	36	Argon	1,2	78	59	13	*
ICLow-E	8-24-4 (S3)	36	Argon	1,2	78	57	12	37 (-3;-7)
ICLow-E	4-12-4-12-4 (2xS3)	36	Argon	0,7	71	50	18	*
ICLow-E	4-12-4-12-4 (2xS3)	36	Krypton	0,5	71	50	18	
ICLow-E	4-14-4-14-4 (S3)	40	Argon	0,6	71	50	18	*
ICLow-E	6-12-4-12-6 (S3)	40	Krypton	0,5	70	49	18	*

* No data available for this type of glazing.

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