
FINNGLASS
SUPERIOR COMFORT
SUSTAINABLE AND ENERGY EFFICIENT
MORE THAN 30 YEARS OF EXPERIENCE

"We believe that the highest value is achieved by innovating radically new solutions based on client needs, including leading glass and metal contractors around the world. Our vision and values are driven by quality, assured by maintaining both product design and manufacturing in our premises in Finland.

Technical solutions are designed and tested using unique simulators and highly advanced analytical tools developed in collaboration with leading universities."

TIMO SAUKKO
CEO AND OWNER

Finnglass is a leading manufacturer of heated glass technology from Finland and has over 30 years of experience developing and manufacturing electrically heated glass for structural glass facades and window solutions to achieve comfort, safety, beauty and sustainable living in the face of the most challenging climates and conditions. Finnglass uses fully CO_2e-free energy for their own production.

HEATED

The Finnglass Heated is a revolutionary advancement in architectural glass technology. It includes a transparent layer that can conduct electricity to produce heat, allowing for flexible usage indoors or outdoors for a wide range of applications. This cutting-edge solution provides advantages like uninterrupted views and improved indoor comfort without the discomfort of cold walls.

INDOOR COMFORT

Finnglass Heated prevents convection - the feeling of cold radiation and drafts when close to traditional non-heated glass. This is also referred to as the "cold wall effect", caused by air close to the glass being cooler than the rest of the room. Cold air descends, moves across the floor, and rises back up, causing the sensation of cold radiation and drafts. Residential, office and commercial buildings in cold climates typically suffer this phenomenon. Finnglass Heated is a solution to this age-old problem.

MELT ICE AND SNOW

Finnglass Heated can melt ice and snow on glass rooftops and skyscrapers, ensuring safety for inhabitants and everyone around. Keep your views unobstructed and your indoors warm and comfortable, even in arctic conditions.

ANTI-CONDENSATION

Finnglass Heated is ideal for preventing condensation on the surface of glass in hot and humid conditions. The trick is to warm the surface of the glass to just a degree or two above dew point. Heating is usually installed on the inner glass when there is high humidity indoors, such as in swimming pools and spas. In hot and humid climates, heating can be installed on the outer glass to prevent condensation on the outer glass surface.

SPECIAL SOLUTION

Finnglass Heated can be used in various specific places in buildings. Typically places that are difficult to reach that need local heating, heated glass provides the best solution as installing and maintaining additional heating units is difficult and unpractical. It can also be combined with anti-slip laser treatment for underfloor heating to increase comfort or for drying floors indoors. Outdoors for snow and ice melting in reducing the risk of slipping and improving safety of use. Finnglass Heated glass is the best solution and with no need to make architectural compromises.

This technology is especially beneficial in colder climates where concerns about ice and snow buildup on glass structures as well as the need for condensation prevention are high. Its simple management and automated heating control make it an efficient and user-friendly choice for contemporary buildings.

COMFORT

Indoor comfort is essential for occupants to enjoy being inside buildings. Spaces with large glass facades and windows can cause decreased thermal comfort in a room which then causes people to feel discomfort.

Finnglass Heated provides a solution that ensures optimal indoor comfort in areas with high requirements for thermal control and expansive glass facades or windows.

COLD WALL EFFECT

Finnglass Heated prevents convection - the feeling of cold radiation and drafts close to traditional non-heated glass surfaces.

This is also referred to "cold wall effect", caused by air close to the glass being cooler than the rest of the room.

Cold air descends, moves across the floor, and rises back up, causing the uncomfortable sensation of cold radiation and drafts.

Discomfort can be noticeable even for as small a temperature difference as 1 °C between the glass' inner surface and the indoor air.

Residential, office and commercial buildings in cold climates typically suffer this phenomenon and Finnglass Heated is a solution to prevent this problem.

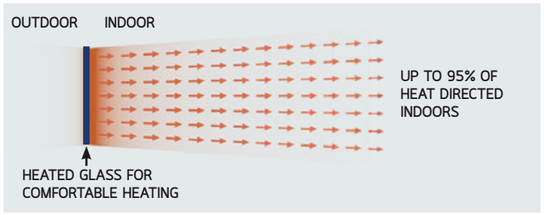
NORMAL GLASS

FINNGLASS HEATED

ENERGY AND SPACE EFFICIENCY

ENERGY EFFICIENCY

Finnglass Heated is very energy efficient. It directs heat where needed and minimizes losses. Depending on the product, efficiency can be up to 95%.



Finnglass Heated can be combined to operate together with a building's main heat distribution system or can even be used as a main heating system. In both cases, it provides the highest level of indoor comfort. To avoid the "cold wall effect," the temperature of the glass is risen just above room temperature.

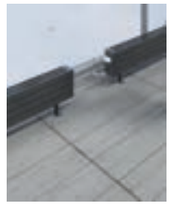
If there is still a demand for heating in the room, it can be done using the building's main heating system or with heated glass. When a room is not occupied, the heated glass temperature can be lowered to save energy. For example, at restaurants, there is no need to use heated glass for comfort reasons outside of opening hours. By connecting and controlling the heated glasses via a building's management system, it is possible to optimize a building's energy efficiency, indoor comfort, and operating cost.

A building's energy calculations rules vary from country to country and there are different environmental certificate systems, such as LEED® and BREEAM®. The designer needs to follow the rules and guidelines of local energy calculation and certification systems.

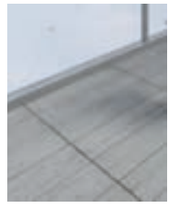
SPACE EFFICIENCY

Traditional heating units often require additional space and may result in architectural compromises that are undesirable. With Finnglass Heated, there is no need for heating units next to a glass façade, allowing for increased architectural freedom. This innovative system enables the creation of valuable spaces that meet high demands, providing top-class interiors and more efficient operational space.

Fancoiled Heating behind a grill



Convector Heating



Finnglass Heating

SHAPES & SIZES

Finnglass Heated is available in flat and cylindrically bent curved glass. Glass can be cut in many different shapes.

Sizes for standard products **min** 300 mm x 300 mm
max 3000 mm x 4800 mm

Larger dimensions and other forms upon request.

FAÇADE SOLUTIONS

Finnglass Heated is very flexible, and the technology allows designers to apply various architectural styles. With heated glass, it is possible to integrate curtain wall and various other types of façade systems.

CURTAIN WALL AND MULLION-TRANSOM FAÇADE

A curtain wall is an outer, non-structural covering of a building. Equal thickness of each vertical mullion profile and horizontal transom profile provides a characterized architectural composition.

SEMI-STRUCTURAL GLAZING WITH TRANSOMS

A horizontal line system enables less visible vertical joints. Horizontal lines stand out, giving a greater horizontal effect for the façade and more a dynamic appearance for a building.

SEMI-STRUCTURAL GLAZING WITH MULLIONS

Similar to the horizontal line system with the difference being that there are vertical lines standing out.Vertical lines give the appearance of slenderness for a building.

STRUCTURAL GLAZING

Structural glazing is a façade system without the visible fastening of glass units. From outside, the joint is made off with silicone sealant or gasket. Reflection of the glass predominance at this solution.

POINT FIXED CURTAIN WALL

The glass is fixed using metal units and sealant is installed around the glass panels. Due the novel system for fixing, transparency and luminosity dominate when using this solution.

DESIGNING FINNGLASS HEATED

Adding Finnglass Heated to your building is a straightforward process. It is crucial to follow Finnglass' technical guidance and reach out to our technical support if necessary to properly specify the glass based on your needs. During the design phase, it is important to outline the specific functionalities desired for the glazing facade solutions.

INDOOR COMFORT

Despite a good U-Value of the glass façade, there are still temperature differences between the glass room side surface and room air. This makes cold air flow down and the cold wall effect causes discomfort. In modern glass façades, the difference between room air temperature and glass room side temperature on a cold winter day can be more than 5 °C. It has been studied with computational fluid dynamics that even a 1 °C temperature difference is enough to create a cold wall effect and cause discomfort. This can be fully eliminated by using heated glass and heating the glass room side temperature to the same level as room temperature.

By using Finnglass Heated, the room side of the glass can be heated reactively and energy efficiently. Energy efficiency can be up to 95%, thus only 5% of the heating energy produced in the heated coating is lost thanks to special construction of the glass and low-e coatings. Studies also show that when Finnglass Heated is used as supplementary heating, room temperature can be reduced by 1 to 2 °C and still maintain the same comfort level. This means a 5 to 10% saving in energy cost.

For the design phase, it is possible to make spaces more efficient using Finnglass Heated. No additional heating devices like fan coils are needed in front of the façade and architecturally clean facades can be created.

It is important that Finnglass Heated can be specialized for all design disciplinaries. For example, architectural, HVAC and electrical design disciplinaries need to specify the technical solution used and implement these into design documents. In the design phase, the capacity required from the heated glass should be determined.

COMFORT HEATING

In the design stage, it is important to specify heated glass for the façade and its intended use. For comfort, the glass room side surface is heated to room temperature and controlled by thermostat, which reacts quickly to weather changes.

ADDITIONAL HEATING

Due to its high efficiency ratio and quick response time, Finnglass Heated is a perfect means to provide additional heating to support a building's main heating system. Additional energy is easily available and hence, desired temperatures can be achieved quickly.

MAIN HEATING

When an appropriate amount of heated glass is installed, it can be used as the main heating system for a space or building. This provides cost savings for investors and freedom of design to architects, as additional systems are not required.

Heated glass can be controlled by a single or double-action thermostat or integrated into a Building Management System (BMS).

MELT ICE AND SNOW

In winter, there's not enough daylight for people's well-being. Therefore, it should be utilized to the fullest. However, even the thinnest layer of snow blocks daylight in overhead glazing. With Finnglass Heated, snow can be removed efficiently and rapidly. It is enough to just increase the temperature of glass to 0 °C. During the design phase, the capacity and amount of energy required need to be calculated and taken into account.

With larger overhead glazing, the total power capacity required can be reduced by dividing the glazing into zones. By designing a suitable number of zones and adjusting the heating time of each zone, snow can be melted effectively and with minimal investment. It is of the highest importance, however, that the capacity of the heated glass is high enough to ensure rapid snow-melting and thus, that the cycle time of zones is also appropriate.

Finnglass Heated has been proved to be a very cost-effective mean for melting snow. Annual operating cost can be as low as 10% of that of manual labor. Heated glass for melting snow can be controlled from a manual or time-based system to the fully automatic system with snow detectors and temperature sensors.

ANTI CONDENSATION

Condensation is a serious problem and can cause mold growth and other problems when it happens inside buildings or structures. In winter conditions, the glass surface is colder than room temperature. When the relative humidity of indoor air is high, it might cause condensation in glass room side surfaces.

Condensation can be fully eliminated from glass surfaces by heating the glass surface to just above dew point temperature and controlled by thermostat. The dew point can be calculated from room air humidity and temperature.

SPECIAL SOLUTION

Double function Finnglass Heated is equipped with separate heating coatings in outside and inside glass. Both heating coatings are controlled and heated separately and can be heated at the same time or independently from each other.

Typically, outside heating is for snow and ice melting and inside heating is for comfort heating, additional heating, main heating or anti-condensation heating.

ELECTRICAL PLANNING

Finnglass Heated features a conductive layer within its insulating glass unit, with electrodes positioned at opposite edges and connected to cables. The system can be set up in parallel configuration. The power supply, control system, and automation are straightforward to implement. It is essential for designers and installers to adhere closely to the guidelines outlined by Finnglass during installation.

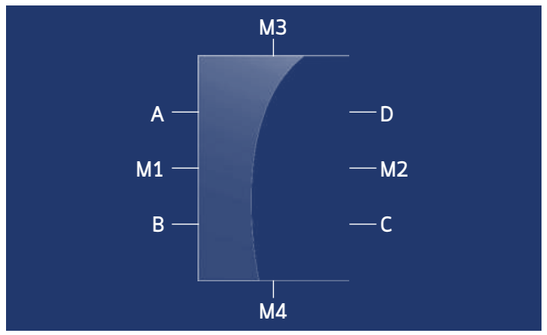
Power for indoor and outdoor	0 ... 700 W/m² (Europa) 0 ... 600 W/m² (USA)
Voltage	0 ... 400 V
Power for marine application	up to 3000 W/m²
Power for special application on request	

OUTLET POSITION

The Outlet position label indicates the location of the cable outcome viewed from the heated side.

A, B, C and D 150 mm from nearest corner.
M1, M2, M3 and M4 in the middle of the heated unit's side.
E = Special location, shown with drawing.

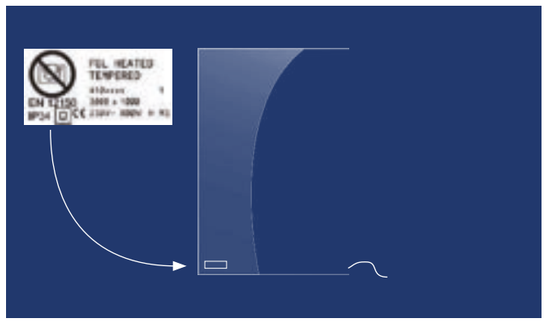
The cable is double insulated. Standard length is 5 meters. Other lengths available on request. Cable outcome can be situated based on design needs.

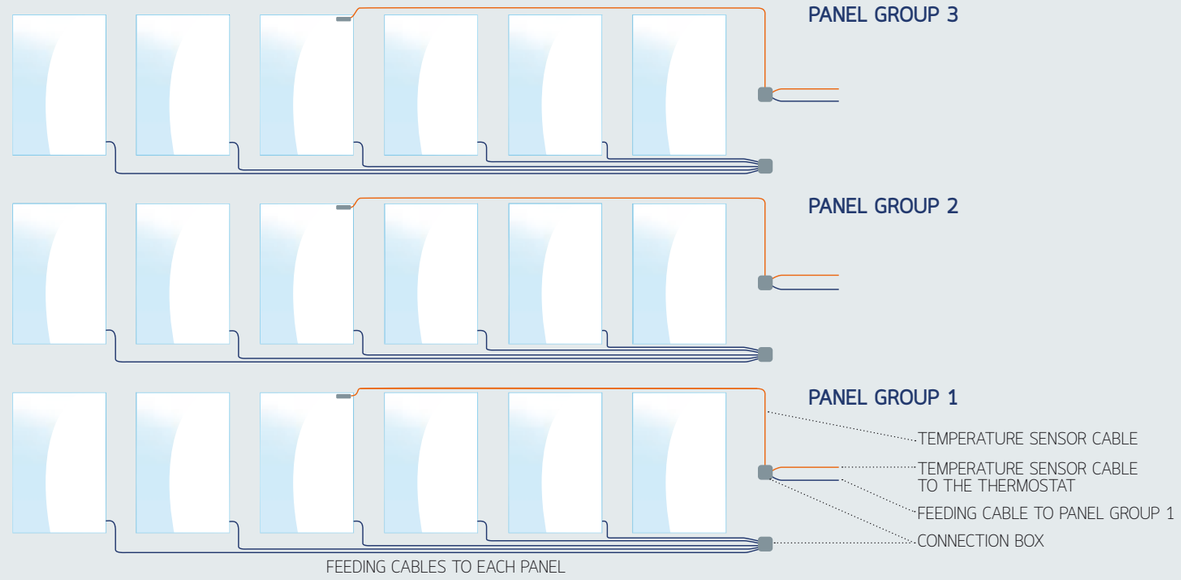


VALUE LABEL

Each glass panel is marked with a value label and thus, every product is traceable and can be reordered as such. The value label contains following information:

410xxxx 1	Number of order confirmation - index
3000 x 1000	Glass dimensions
230V- 800W H M3	Connection voltage (230V), power of the element (800W), location of electrodes (H - Horizontal / V - Vertical), location of connection cable (M3).





MEASURES BEFORE ELECTRICAL CONNECTIONS AND WIRING

Before installing each heated pane, resistance needs to be measured on-site. Compare the result with the values given by the Finnglass test protocol with heated glass elements resistance values. Values measured on site should be within +/-15%. If this is not met, the manufacturer should be consulted.

With metal frames, ground connections need to be provided. Local norms and regulations must always be followed.

WIRING PRINCIPLE - CURTAIN WALL

CONTROL AND AUTOMATION

There are many alternatives to control Finnglass Heated. All control strategies can be managed via Building Management System (BMS).

COMFORT HEATING

The inside glass surface is heated to room temperature and controlled by thermostat. Heating time can be limited to times when the building is in active use. This also saves the energy consumption of the building. A sensor is placed in a top corner of the glass. Normally one sensor is needed per room or per façade in the same room.

If a façade is directed to different orientations, then one sensor and one thermostat are used for each orientation. Thermostats can be in electrical cabinets. The thermostat can be supplied with glass delivery. Appropriate thermostat types and more information is available in the installation instructions.

ADDITIONAL HEATING

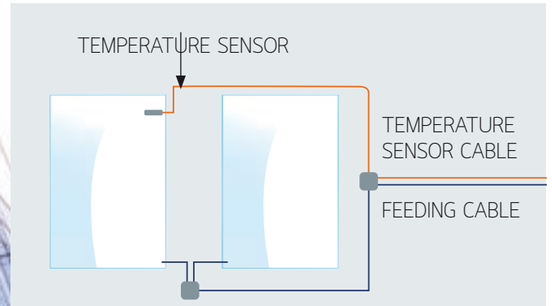
If the main heating system cannot react enough quickly to weather changes or if the capacity is limited, heated glass can be used as additional heating.

In that case, it is controlled by double thermostat so that the glass surface is kept at least at room temperature and, additionally, will heat more so that the room temperature is stable. This function is very energy efficient and provides good comfort even in the coldest conditions.

MAIN HEATING

Finnglass Heated can be used as a main heating system. The required heating capacity needs to be calculated and then compared if the heating area of the glass is enough for the room. The capacity of the heated glass in Europe is 700W/m^2 and in North America 600W/m^2. Heating is typically controlled by room thermostat or double thermostat.

PARALLEL CONNECTION



ANTI-CONDENSATION

The dew point can be calculated from room temperature and air humidity. The most efficient way to prevent condensation in a glass room side surface is to keep the glass surface at same level as room temperature.

Energy consumption can be minimized if the glass surface is heated just above dew point. In that case, it is important to check that there is no condensation in materials near the glass such as aluminum profiles etc. Glass surface temperature is controlled by a sensor in the glass surface and thermostat. The sensor is placed in a top corner of the glass, left or right.

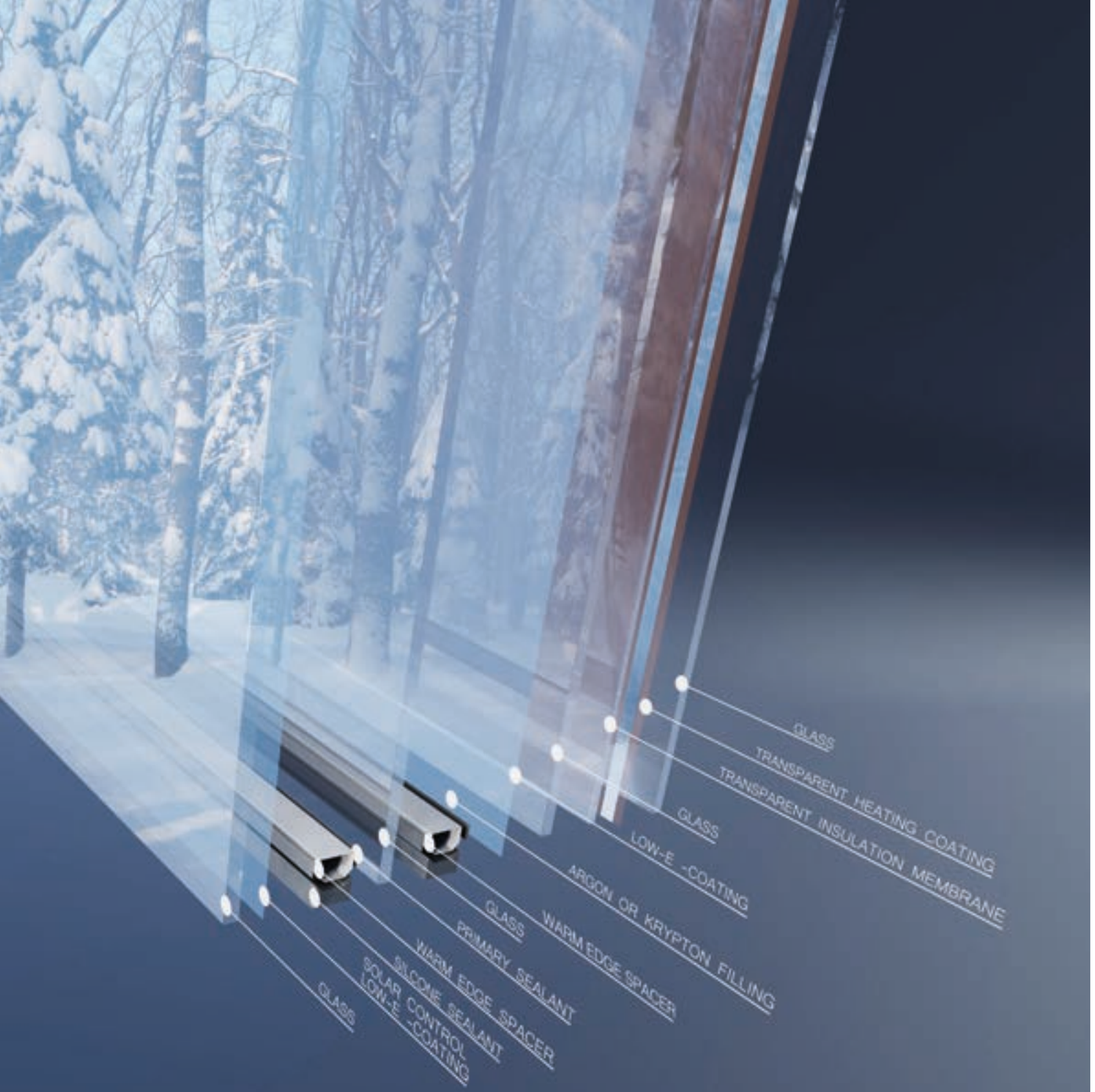
SNOW AND ICE MELTING

The snow melting function can be controlled either manually, semi- automatically or automatically. With manual control, snow melting heating is switched on and off manually. Semiautomatic control is done via timer so that snow melting is switched on manually and is active for certain periods, like 15 minutes at a time, and switches off after the heating period.

The automatic control system is equipped with snow sensors, thermostats, and the heating switches on automatically when it snows. Snow sensors are necessary to locate in the same area as, or very near, where snow and ice will melt. It is necessary to install temperature sensors on the glass surface.

DOUBLE FUNCTION GLASS

Both the snow and ice melting functions, with comfort heating, anti- condense, additional heating or main heating, are controlled like independent functions.



PRODUCTS AND TECHNICAL DATA

There are several types of Finnglass Heated available. Single glass units and insulating glass units, double, triple, quadruple, are most common. In addition to these, there are great variety of features that can be applied to Finnglass Heated according to the needs.

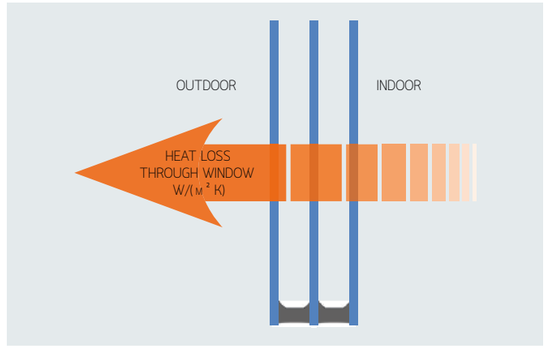
PRODUCTS

Finnglass Heated is customizable to meet specific requirements, including U-Values, g-Values, Tv, Low Iron, anti-condensation, and other features tailored to each building's needs. Architects, in collaboration with other design disciplines, must specify the desired properties for glazing during the design phase to ensure the selection of the appropriate product with the desired features.

U-Value

The U-Value is a measure of how much heat escapes via the windows, facades, walls, and roof, for example. In the glass industry, it is often expressed as the U-Value of the glass (Ug). The lower the U-Value, the better the insulating capacity of the glass. The U-Value can be improved against cavities by the glass surfaces being coated with a silver or tin-based surface, which reflects longwave radiation back into the room.

A U-Value of 1.0 means a heat flow of 1 Watt per square meter surface area for every degree of Kelvin, which separates the outdoor and indoor temperature. The unit for the U-Value is W/(m² K).



g-Value

The g-Value is a measure of how much solar heat (infrared radiation) is allowed in through a particular part of a building. A low g-Value indicates that a glass lets through a low percentage of the solar heat. The g-Value can be lowered by having the outer glass pane coated with a reflective surface to reflect some of the radiant heat.

This also partly aims to reduce the costs of cooling the property, and to improve the indoor environment in properties without comfort cooling. The g-Value is a number between 0 to 1 and has no unit.

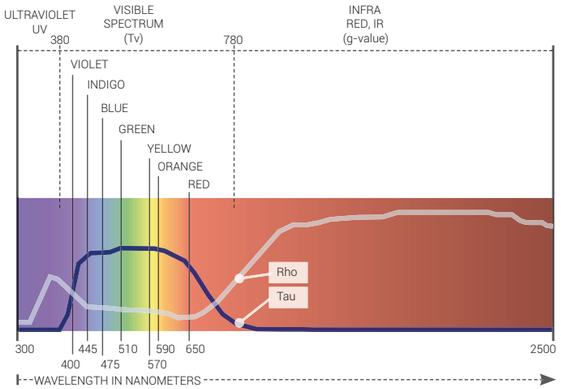
TV, LIGHT TRANSMITTANCE

Tv means light transmittance and it is the proportion of the visible spectrum which is transmitted by the glass, expressed as a fraction. Light transmittance can be improved by using low iron glasses and different coatings.

HEAT SOAK TEST (HST)

Float glass contains some Nickel sulfide (NiS) particles which come from the raw material (sand) of the float. The average in European float lines is one NiS particle per 8,7 tons of glass. NiS may cause self-breakage of the tempered glass, the risk of which can be minimized by doing a heat soak test (HST) treatment for each glass.

Glass containing NiS will break during the test and later breakage risk is minimized.



Rho - indicates reflection from the glass within a certain wavelength. It is a number between 0 to 1 and has no unit, 1 meaning fully reflective glass and 0 no reflection. With float glass, the Rho value is about 0.08 regardless of wavelength. In practice, it is easier to see through glass with lower Rho values, which is often a required feature. It has been noted that a lower Rho values prevents birds colliding with glass.

Tau - indicates the penetration value through glazing within a certain wavelength. It is a number between 0 to 1 and has no unit, 1 meaning full penetration and 0 no penetration.

LR, LIGHT REFLECTION

Light reflection tells you how much light is reflected by the glass. It has an important impact on building aesthetic and bird safety. High reflection may cause disturbing conditions to the surrounding area in urban environments. Thus, a lower reflection value is often preferred. Lower reflection glass improves bird safety.

Ra, COLOR RENDERING INDEX

Ra express differences in the colors of natural light compared to the same natural light transmitted through the glass. The value is between 0-100 and the higher the value, the better the color rendering index (Ra). Colors look more natural when a higher Ra index glass is used.

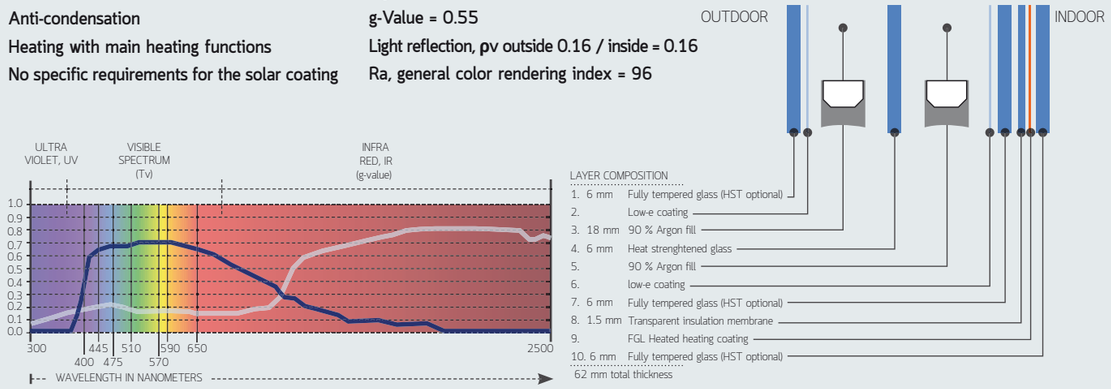
EXAMPLES NO SOLAR COATING

The Finnglass Heated system can be paired with a variety of products, such as burglar-proof glass, our bird-friendly solutions Lintu-Laser and Laser-Bird, ballistic and explosion protection, electromagnetic shielding glass, anti-reflection glass, and anti-condensation glass. Below are some common combinations for heating comfort, eliminating snow, and dual functionality. All items are offered with or without a solar coating.

COMFORT HEATING

Anti-condensation
Heating with main heating functions
No specific requirements for the solar coating

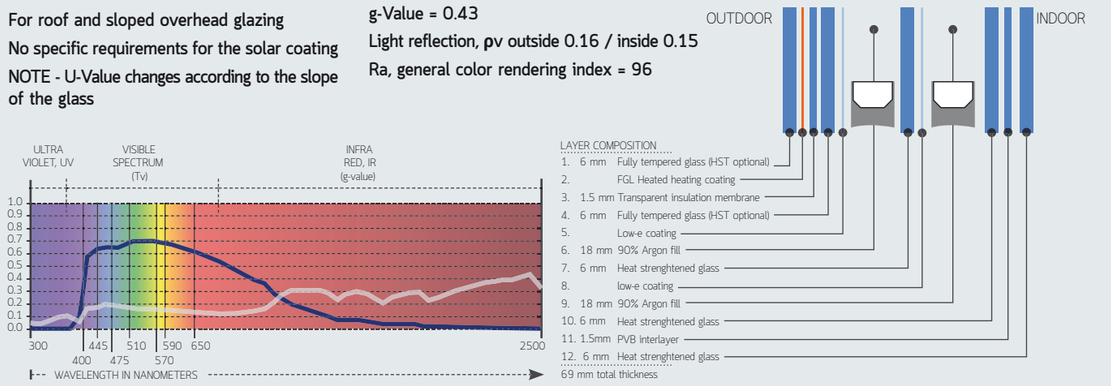
Tv = 0.69
Ug-Value = 0.52
g-Value = 0.55
Light reflection, ρv outside 0.16 / inside = 0.16
Ra, general color rendering index = 96



SNOW MELTING

For roof and sloped overhead glazing
No specific requirements for the solar coating
NOTE - U-Value changes according to the slope of the glass

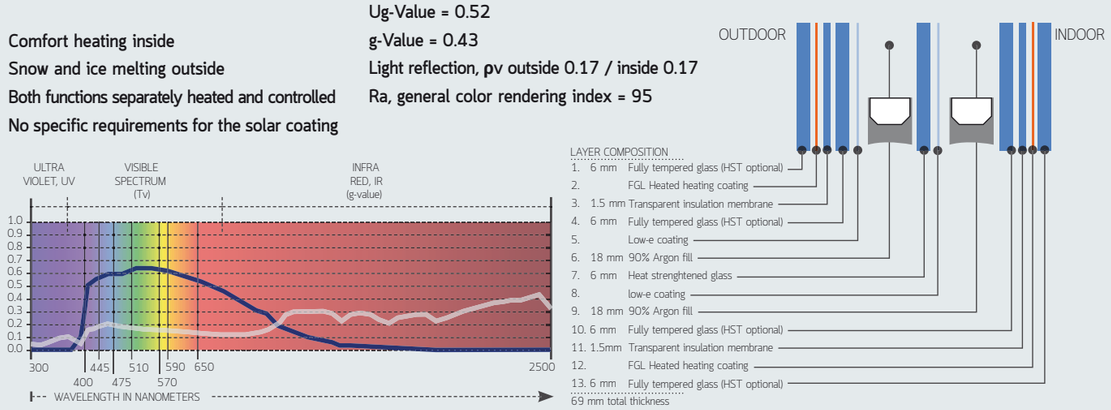
Tv = 0.68
Ug-Value = 0.52
g-Value = 0.43
Light reflection, ρv outside 0.16 / inside 0.15
Ra, general color rendering index = 96



DOUBLE FUNCTION

Comfort heating inside
Snow and ice melting outside
Both functions separately heated and controlled
No specific requirements for the solar coating

Tv = 0.63
Ug-Value = 0.52
g-Value = 0.43
Light reflection, ρv outside 0.17 / inside 0.17
Ra, general color rendering index = 95



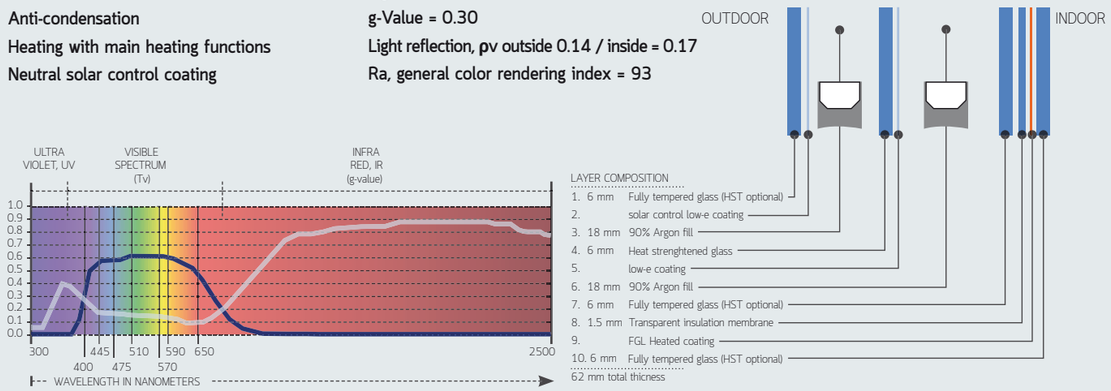
EXAMPLES WITH SOLAR COATING

All Finnglass Heated products comply with the following harmonized standards:
EN 12150, EN 14179, EN 1863, EN 14449, EN 1279, EN 60335, EN 62233, UL 962, C22.2 No. 0-10 General Requirement Canadian Electrical Code Part II

COMFORT HEATING

Anti-condensation
Heating with main heating functions
Neutral solar control coating

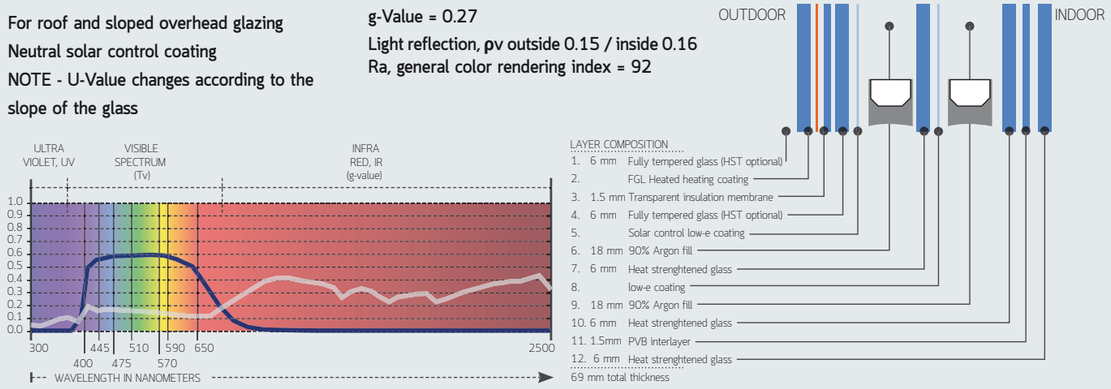
Tv = 0.59
Ug-Value = 0.49
g-Value = 0.30
Light reflection, ρv outside 0.14 / inside = 0.17
Ra, general color rendering index = 93



SNOW MELTING

For roof and sloped overhead glazing
Neutral solar control coating
NOTE - U-Value changes according to the slope of the glass

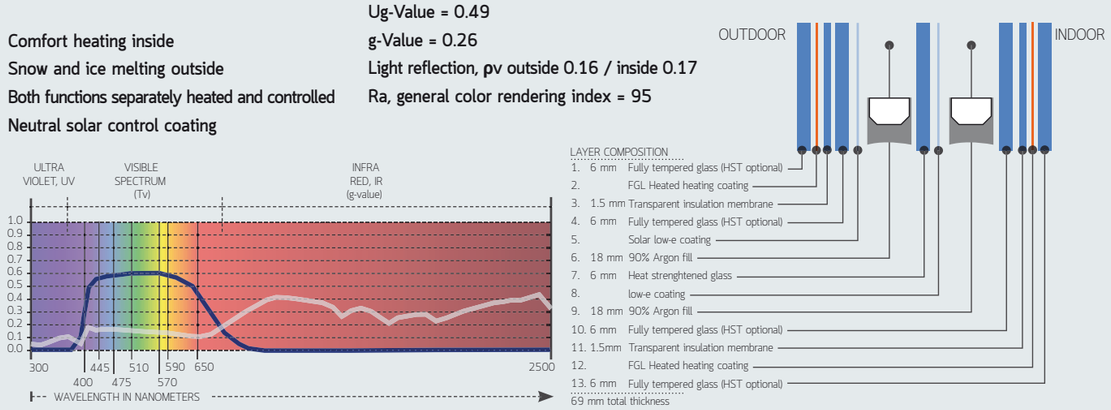
Tv = 0.59
Ug-Value = 0.49
g-Value = 0.27
Light reflection, ρv outside 0.15 / inside 0.16
Ra, general color rendering index = 92



DOUBLE FUNCTION

Comfort heating inside
Snow and ice melting outside
Both functions separately heated and controlled
Neutral solar control coating

Tv = 0.54
Ug-Value = 0.49
g-Value = 0.26
Light reflection, ρv outside 0.16 / inside 0.17
Ra, general color rendering index = 95



REFERENCES

Finnglass has supported its customers in various types of projects with the state-of-the-art technology and expertise, thus enhancing the well-being of people and improving habitat.

ONE VANDERBUILT - SUMMIT LIFTS
NEW YORK

Customer: Cimolai Technology SPA
FGL electrically heated glass with anti-reflective coating

TIKKURILA RAILWAY STATION
FINLAND

Customer: Nordec Envelope
Volume 5.500 m²

Safety glass with solar control and anti-condensation function and FGL electrically heated glass, structural glazing, all glass heat-strenghtened or tempered laminated.

POHJOISESPLANADI 37, HELSINKI
FINLAND

Customer: Teräselementti Oy

A 14-metre-high steel "golden tree" structure supports 3 x 3 metre triangular-shaped FGL HEATED triple insulating glass panels that cover the courtyard of the Gaselli Quarter at Pohjoisesplanadi 37 in Helsinki.

REFERENCES

LEVI IGLOS
FINLAND

Glass igloos enable being one with nature while providing superior indoor comfort all year round. Due to continued success, more and more igloos are being built.

We provided Finnglass Heated to these unique igloos to meet the high demands of indoor comfort and snow melting for unobstructed visibility.

KOTKANPESÄ
HOTEL ISO - SYÖTE

FGL electrically heated insulating glass for indoor comfort.

ARTIC RESORT KAKSLAUTTANEN
FINLAND

Volume over 6.000 m²
FGL electrically heated insulating glass Finnglass has developed the whole solution including electrical planning.

Two sided electrically heated glass, heating and snow melting function separately. In North Finland, temperature can decrease 20 °C in 1 hour, so FGL heated glass is the best solution which can react such quickly to these extreme weather conditions.

REFERENCES

TINY HOUSES OF OLOKOTO STEALTH

KIIMINKI

The Finnish landscape is perfectly reflected on the 3 m x 3 m fully tempered chrome-spy-mirror triple-glazed insulating units.

The vertical and roof glazing elements are functioned with our invisible heatable coating to allow for highest living comfort.

HIGHEND RESIDENTIAL PROJECTS

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First Class Scandinavian Design

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