

# White Paper

LowE Basics

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**Australian  
GlassGroup®**

# LowE Basics

LowE glass is Low Emissivity coated glass. Think of Emissivity of how much heat can go through the glass... if it is a low amount as 'Low Emissivity' states, then there is something special about that glass that stops more amounts of heat going through it, compared to regular float glass.

To understand how LowE coated glass works, we must understand the basics of heat transfer...

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## Heat Transfer

Heat wants to go from where it is hot to where it is not. When it is hot outside, heat derived from the sun wants to come inside – we call this Heat Gain. When it is cold outside, heat from inside our buildings wants to go out – we call this Heat Loss.

Heat will find the path of least resistance to travel from 'hot to not' and in a building with brick walls and aluminium windows, the clear glass and the frame material is the path of least resistance as regular clear glass and standard aluminium are both great conductors of heat – meaning heat can pass through them very easily.

Think of Heat as two main types:

- **Type #1 Heat:** heat from the Sun
- **Type #2 Heat:** all other type of heat generated from here on Earth

### Type #1 Heat

Heat from the Sun, also known as 'Solar Heat' and 'Passive Heat'.

The factor here being Solar Control - how much heat from the Sun comes into our building and therefore, how much is blocked.

This can be measured by the Solar Heat Gain Coefficient (SHGC).

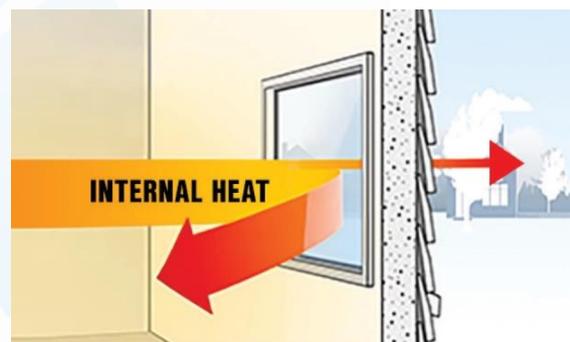


### Type #2 Heat

Also known as Conductive and Convective Heat, it is all other heat including; body heat, heat from oil heaters, electric heaters, air conditioning units, fire places...

The factor here being Insulation - how much heat we retain inside when it is colder outside.

It can be measured by the U-Value.



Type #1 Heat	Type #2 Heat
Heat from the Sun	All other Heat
aka. Solar Heat, Passive Heat	aka. Convective Heat, Conductive Heat
Factor: Solar Control	Factor: Insulation
Measured by: SHGC	Measured by: U-Value

The two types of heat are different by their electromagnetic wavelength signatures. Relevant radiation particles that we receive from Type #1 Heat from the Sun are; Visible Light, Ultraviolet Light and Infrared. It is the Infrared particles that contain the heat factor. Visible Light and Ultraviolet Light wavelengths are shorter in frequency compared to Infrared wavelengths; however Infrared wavelengths are still longer than all other Type #2 Heat wavelengths.

This is how a single glazed Grey Tinted glass can block high levels of Visible Light, UV and Infrared Heat, but have little effect on Type #2 Heat, in fact the exact same little effect that regular single glazed Clear glass offers.

By using Clear glass in a Double Glazed Unit (DGU), you affect the conduction properties of the glass for longer wavelength Type #2 Heat by stopping a lot more of the longer wavelength heat from escaping while still allowing shorter wavelength Light and Infrared heat from the Sun to enter inside.

It is the encapsulated air gap that allows such performance against Type #2 Heat and this is why a regular DGU with clear glass has much better Insulation properties than any single glazed option, including single glazed Hardcoat LowE coated glass. Adding argon gas into that air gap adds further Insulation properties (lower U-Value) by stopping even more longer wave Type #2 Heat from passing thorough and this is why AGG offer all of our IGU products with argon gas as standard (*may exclude some specialised sizes*).

This is also how a LowE coated glass in a DGU offers the best options in multiple performances; either a Clear LowE (eg. Insulglass LowE Plus<sup>®</sup>) that allows Light and Infrared Heat from the Sun inside but blocks significant levels of Type #2 Heat from escaping – an ideal solution for colder climates.

Or a Solar Control LowE (eg. Insulglass LowE Max<sup>®</sup>) that covers all factors, allowing healthy levels of Light to enter inside but blocks significant levels of infrared Heat from the Sun heat from entering, while also stopping significant levels of Type #2 Heat from escaping – an ideal solution for Commercial buildings or Residential buildings in warm-hot climates.

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## R-A-T

A helpful acronym here is RAT (Reflection, Absorption & Transmittance).

When looking at Type #1 Heat from the Sun, this heat travels in one direction, predominantly from the sun to the inside of our buildings via the glazing (the path of least resistance compared to a brick wall).

When 100% of the heat that reaches the window, instantly some of that heat is Reflected away, of the remaining energy some gets Absorbed by the glass and framing and the rest Transmits all the way through.  $R + A + T = 100\%$  of the original heat.

When looking at Type #2 Heat generated inside a building on a cold day or night, this heat travels to the window wanting to escape. This heat will also follow the Reflection, Absorption, and eventual Transmittance pattern.

Different glass and different framing material will have different ratios of Reflection and Absorption of heat, which both affect the end Transmittance value. The same window will also have different performances against Type #1 Heat versus Type #2 Heat. The glass type that offers the best values and best balance of both, is LowE coated glass. The frame material type that offers the best values are; Thermally Broken Aluminium, Timber, uPVC or composites using a combination of materials acting as a thermal break.

Tinted glass (eg. Grey Tint) has a higher Absorption of Type #1 Heat compared to regular float glass but has the exact same effect of Type #2 Heat... which is minimal affect.

Clear LowE coatings (eg. Insulglass LowE Plus®) have higher Reflection and Absorption values of type #1 Heat compared to regular float glass but is still allows high levels of Transmitted Type #1 Heat from the Sun inside.... And at the same time, it has excellent Reflection of Type #2 Heat for advanced Insulation... which is the desired set of performance for colder climates.

Solar Control LowE coatings (eg. Insulglass LowE Max®) have a great balance of both Reflection and Absorption of Type #1 Heat... and also significant Reflection of Type #2 Heat making it an ultimate solution and ideal for Commercial buildings and Residential buildings in warm-hot climates.

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## Two Types of LowE

Hardcoats (HC) and Softcoats (SC).

Hardcoats are Pyrolytic LowE metallic coatings that have been a traditional LowE in the market place. It is applied 'on-line' to float glass during the float glass manufacturing via Chemical Vapour Deposition (CVD) which is sprayed on while the glass is still red hot just before the annealing process, becoming embodied and part of the glass material hence the Hardcoat terminology. A Hardcoats key performing metal is Indium Tin Oxide (ITO) and a key benefit of a Hardcoat LowE is that it can be used single glazed with the coating exposed (generally to the inside of the building, protected from the outside elements).

Softcoats are Sputter Coated LowE metallic coatings and applied to float glass via Physical Vapour Deposition (PVD) after the completed float glass production on a separate sputter coating line. Here atomic particles of metals and metal oxides are deposited on the float glass hence the Softcoat terminology. A Softcoats key performing metal is Silver (Ag) which can offer higher performance than a Hardcoat LowE, however the Silver requires protection from the environment and so must allow go in an Insulated Glass Unit (IGU) and have its coating protected from exposure, inside the air gap. Softcoat LowE cannot be used single glazed or have its coating exposed.

Softcoats can be further identified into 3 main types:

- Single Silver
- Double Silver
- Triple Silver
- (Quad Silvers are also being developed)

These refers to how many layers of Silver are in the make-up of the coating. Think of Single Silver Softcoat LowE coating as a club sandwich - the ham in the middle being the Silver layer which is surrounded and protected by other metal oxide layers (the cheese, lettuce, tomato, and bread). These Single Silvers could be around 8-11 atomic layers in total with just the one in the middle being Silver.

Now add another club sandwich on top and you can have around 16-18 layers in total with 2 of them being Silver.

Now add another club sandwich on top and you can have around 28 layers in total with 3 of them being Silver.

Note that being atomic layers, 28 layers in total are still less than 1/1000<sup>th</sup> the thickness of human hair.

Hardcoat LowE (HC)	Softcoat LowE (SC)
Pyrolytic LowE	Sputter Coated LowE
Online – spered (CVD)	Offline – sputtered (PVD)
Indium Tin Oxide (ITO)	Silver (Ag)
Can be used Single Glazed	Require IGU

While Hardcoats offer the best possible performance for any single glazed applications, in an IGU a Softcoat will provide more advanced performance as well as better looks. The way Hardcoats are made influence the straightness of the float glass substrate. Being sprayed on while still red hot causes peaks and troughs in the surface of the glass that can see light distractions by the scattering of light causing a haze appearance. Also, if used single glazed then the coating is exposed on the inside of a building and susceptible to touch, scratches and affects from cleaning products.

Awareness and care must be taken into consideration when using Hardcoats in single glazed application. Softcoats however are applied onto already manufactured float glass and do not affect the straight surface and with the requirement of an IGU the coating is always inside the air gap, protected from both the outside elements and touch from the inside of buildings.

## Benefits of Softcoat LowE

As Softcoat LowE requires an IGU, if you look first at going from monolithic single glazed (eg. 6mm Clear) to a Double Glazed Unit (DGU) you have two foundational benefits being; significantly better Insulation and more advanced Acoustic performance. Then by adding a Softcoat LowE we further benefit from:

1. One-off HVAC system savings for new builds (reducing to a less expensive option due to Energy Efficient glass/glazing reducing Heating and Cooling loads)
2. Ongoing Heating cost savings (from ongoing reduced Heating loads)
3. Ongoing Cooling cost savings (from ongoing reduced Cooling loads)
4. Ability to increase or maintain large sizes without compromising performance
5. Virtually eliminate Internal Condensation forming on the glass
6. Increased Ultraviolet protection from fading factors
7. Add Resale value to the building / attract higher level of tenants if renting
8. Ultimately creating a Happier, Healthier inside with better Comfort levels

# Glass Only Performance Values

AGG's key range of Softcoat LowE Double Glazing:



An ideal Softcoat LowE DGU for warmer climates to minimise Glare and a balance of Solar Control & great Insulation.



An ideal Softcoat LowE DGU for colder climates with maximum Visible Light, Passive Heat Gain & excellent Insulation.



An excellent Softcoat LowE DGU to advance both Solar Control and Insulation without compromising Visible Light.



A superior Softcoat LowE DGU to maximise both Solar Control and Insulation without compromising Visible Light.

## Insulglass LowE Prime® Performance Data

Double Glazed Units (DGU)	Colour	Visible Light VLT	Insulation U-Value	Solar Control SHGC
<b>Insulglass LowE Prime® - Clear</b>				
4mm LowE Prime/12mm argon/4mm Clear	Neutral	69	1.7	0.55
5mm LowE Prime/12mm argon/5mm Clear	Neutral	68	1.7	0.54
6mm LowE Prime/12mm argon/6mm Clear	Neutral	68	1.6	0.54
8mm LowE Prime/12mm argon/8mm Clear	Neutral	67	1.6	0.52
<b>Insulglass LowE Prime® - Grey</b>				
4mm Grey/12mm argon/4mm LowE Prime	Grey	43	1.7	0.48
6mm Grey/12mm argon/6mm LowE Prime	Grey	34	1.6	0.40
<b>Insulglass LowE Prime® - Clear Laminate</b>				
4mm LowE Prime/12mm argon/6.38mm Clear lam	Neutral	69	1.6	0.55
6mm LowE Prime/12mm argon/6.38mm Clear lam	Neutral	68	1.6	0.54
<b>Insulglass LowE Prime® - White Translucent Laminate</b>				
4mm LowE Prime/12mm argon/6.38mm WTrans lam	White	52	1.6	0.53
6mm LowE Prime/12mm argon/6.38mm WTrans lam	White	52	1.6	0.52

Note: Data using centre of glass performance in NFRC standards with argon gas and LowE Prime coating to surface #2 except the Grey options having coating on surface #3.

## Insulglass LowE Plus® Performance Data

Double Glazed Units (DGU)	Colour	Visible Light VLT	Insulation U-Value	Solar Control SHGC
<b>Insulglass LowE Plus® - Clear</b>				
4mm Clear/12mm argon/4mm LowE Plus	Clear	81	1.4	0.61
5mm Clear/12mm argon/5mm LowE Plus	Clear	80	1.4	0.60
6mm Clear/12mm argon/6mm LowE Plus	Clear	79	1.4	0.59
8mm Clear/12mm argon/8mm LowE Plus	Clear	78	1.4	0.57
<b>Insulglass LowE Plus® - Grey</b>				
4mm Grey/12mm argon/4mm LowE Plus	Grey	51	1.4	0.44
6mm Grey/12mm argon/6mm LowE Plus	Grey	39	1.4	0.36
<b>Insulglass LowE Plus® - Clear Laminate</b>				
6.38mm Clear lam/12mm argon/4mm LowE Plus	Clear	80	1.4	0.56
6.38mm Clear lam/12mm argon/6mm LowE Plus	Clear	79	1.4	0.56
<b>Insulglass LowE Plus® - White Translucent laminate</b>				
6.38mm WTrans lam/12mm argon/4mm LowE Plus	White	61	1.4	0.46
6.38mm WTrans lam/12mm argon/6mm LowE Plus	White	60	1.4	0.45

Note: Data using centre of glass performance in NFRC standards with argon gas and LowE Plus coating to surface #3.

## Insulglass LowE Advance® Performance Data

Double Glazed Units (DGU)	Colour	Visible Light VLT	Insulation U-Value	Solar Control SHGC
<b>Insulglass LowE Advance® - Clear</b>				
6mm LowE Advance/12mm argon/4mm Clear	Clear	72	1.3	0.35
6mm LowE Advance/12mm argon/5mm Clear	Clear	71	1.3	0.35
6mm LowE Advance/12mm argon/6mm Clear	Clear	71	1.3	0.35
8mm LowE Advance/12mm argon/8mm Clear	Clear	70	1.3	0.34
<b>Insulglass LowE Advance® - Grey</b>				
6mm Grey/12mm argon/6mm LowE Advance	Grey	35	1.3	0.26
8mm Grey/12mm argon/8mm LowE Advance	Grey	27	1.3	0.22
<b>Insulglass LowE Advance® - Clear Laminate</b>				
6mm LowE Advance/12mm argon/6.38mm Clear lam	Clear	71	1.3	0.35
8mm LowE Advance/12mm argon/8.38mm Clear lam	Clear	71	1.3	0.34
<b>Insulglass LowE Advance® - White Translucent Laminate</b>				
6mm LowE Advance/12mm argon/6.38mm WTrans lam	White	54	1.3	0.34
8mm LowE Advance/12mm argon/6.38mm WTrans lam	White	54	1.3	0.33

Note: Data using centre of glass performance in NFRC standards with argon gas and LowE Advance coating to surface #2 except the Grey options having coating on surface #3.

## Insulglass LowE Max® Performance Data

Double Glazed Units (DGU)	Colour	Visible Light VLT	Insulation U-Value	Solar Control SHGC
<b>Insulglass LowE Max® - Clear</b>				
6mm LowE Max/12mm argon/4mm Clear	Neutral	67	1.3	0.27
6mm LowE Max/12mm argon/5mm Clear	Neutral	66	1.3	0.27
6mm LowE Max/12mm argon/6mm Clear	Neutral	66	1.3	0.27
8mm LowE Max/12mm argon/8mm Clear	Neutral	65	1.3	0.27
<b>Insulglass LowE Max® - Low Iron</b>				
6mm LowE Max/12mm argon/6mm Low Iron	Neutral	68	1.3	0.27
<b>Insulglass LowE Max® - Grey</b>				
6mm Grey/12mm argon/6mm LowE Max	Grey	33	1.3	0.22
8mm Grey/12mm argon/8mm LowE Max	Grey	25	1.3	0.19
<b>Insulglass LowE Max® - Clear Laminate</b>				
6mm LowE Max/12mm argon/6.38mm Clear lam	Neutral	66	1.3	0.27
<b>Insulglass LowE Max® - White Translucent Laminate</b>				
6mm LowE Max/12mm argon/6.38mm WTrans lam	White	51	1.3	0.26

Note: Data using centre of glass performance in NFRC standards with argon gas and LowE Max coating to surface #2 except the Grey options having coating on surface #3.

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## AGG NSW

140 Gilba Rd  
Girraween, NSW  
P: (02) 9896 0566  
F: (02) 9896 0190

## AGG VIC

81-83 Rushdale St  
Knoxfield, VIC  
P: (03) 9730 7400  
F: (03) 9730 7488

## AGG TAS

39 South Arm Rd  
Rokeby, TAS  
P: (03) 6247 1625  
F: (03) 6247 6843



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