with film splitting the chamber

4mm Low-e 1.1

12mm Krypton 95% + Argon 5%

Transparent film *with antiglare coating*

12mm Krypton 95% + Argon 5%

4mm Low-e 1.1

Designation: **STANDARD**

Thickness: **33 mm**

Heat transfer: **Ug = 0.4 W/m²K**

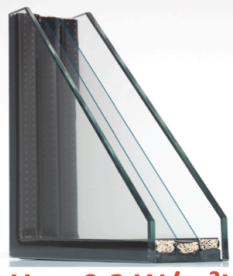
Day light: **Tvis. =** ~~**73%**~~ *80%*

Solar gain: **G =** ~~**53%**~~ *56%*

Five (5) advantages against TRIPLE GLAZING:

1. Without risk of rupture the inner glasses (due partial sun-illuminated area)
2. The chambers are pressure-equalized **=> lower inflation & deflation => lower gas leakage**
3. Improved acoustic attenuation **(+2dB)**
4. **Better Ug** (**less thickness** and also **lower thermal conductivity** of the film)
5. **Triple-glazing** is about **50% heavier**

3-chamber double-glazing:



4mm Low-e 1.1

10mm Krypton 95% + Argon 5%

Transparent film w. Antireflex coating

12mm Krypton 95% + Argon 5%

Metalised film HM88

10mm Krypton 95% + Argon 5%

4mm Low-e 1.1

Designation: **SUPER**

Thickness: **42 mm**

Heat transfer: **Ug = 0.3 W/m²K**

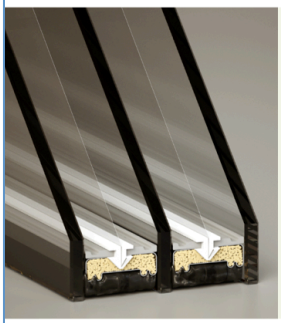
Day light: **Tvis. =** ~~**66%**~~ 71%

Solar gain: **G =** ~~**44%**~~ 47%

Ug = 0.3 W/m²K

- Best acoustic attenuation (less 3-4 dB than tripple-glazing)
- Thickness like common tripple-glazing (*with Ug=0.5 W/m²K*)
- Removes all known disadvantages of quadruple-glazing
- All chambers are pressure equalized
- **Weight of double-glazing**

4-chamber triple glazing: Ug = 0,2 W/m²K



4mm Low-e 1.1

12mm Krypton 95% + Argon 5%

Transparent film

10mm Krypton 95% + Argon 5%

4mm bothsides metalising

10mm Krypton 95% + Argon 5%

Transparent film

12mm Krypton 95% + Argon 5%

4mm Low-e 1.1

Designation: **SUPER**

Thickness: **56 mm**

Heat transfer: **Ug = 0.2 W/m²K**

Day light: **Tvis. = 51%**

Solar gain: **G = 32%**

What should be solved before producing:

1) **Window-frames (IG thickness > 56mm)**
2) **Condensed water (or frost) on outer glass**
3) **Gas volume and its expansion**

3) Gas thermal expansion causes problems:

= Distorted reflection due inflated IG's ☹

= Butyl is stressed = gas leakage ☹

= The bigger is bending the thicker must be the glass pane => ☹ increasing of weight

By development

FILM in SPACER

was discovered, that the

SPACER with GROOVE

avoids perfect

GAS LEAKAGE

Laboratory test

AGC GLASS UNLIMITED

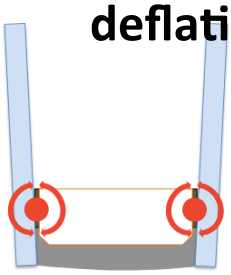
of FILM in SPACER samples MEMO

Samples received have been evaluated according EN1279. All samples have been measured with Argon gas tester, results are presented on table 1. Only 1 cavity has been measured due to specific glazing structure. "Gas" tested samples have been already measured also after ½ CEN. Samples were OK after ½ CEN, based on Argon tester (non-destructive).

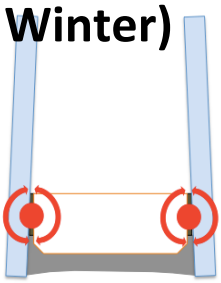
Sample #	Argon content before ageing	Type of ageing	Argon content after ageing
1	75,0%	Reference	
2	93,0%	Gas (1/2 CEN)	→ 93,0%
3	90,0%	Humidity (CEN)	
4	86,0%	Humidity (CEN)	
5	95,6%	Gas (1/2 CEN)	→ 95,6%
6	84,0%	Reference	
7	84,0%	Reference	
8	92,7%	Gas (1/2 CEN)	→ 92,7%
9	86,0%	Humidity (CEN)	
10	85,0%	Reference	

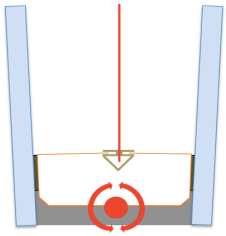
How is it possible?...

Gas usually leaks due inflating and deflating (in Summer and Winter)

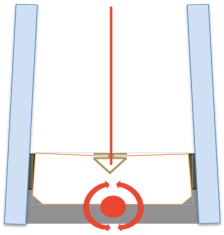


by common IG is
the butyl stressed
(and the gas leaks…)



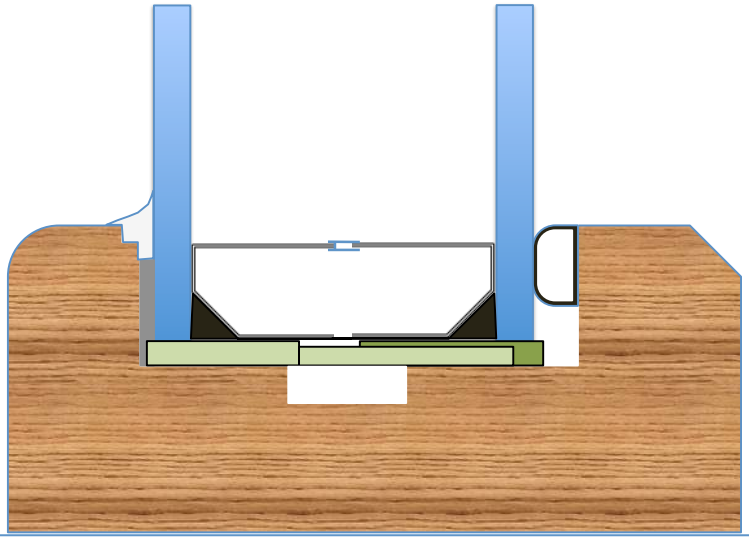


by **FILM in SPACER**
butyl isn't stressed
(and the gas keeps inside)



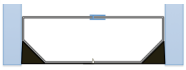
3) Gas thermal expansion

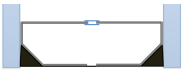
SOLUTION: Spacer with variable thickness:



3) Gas thermal expansion

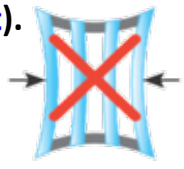
SOLUTION: Spacer with variable thickness:





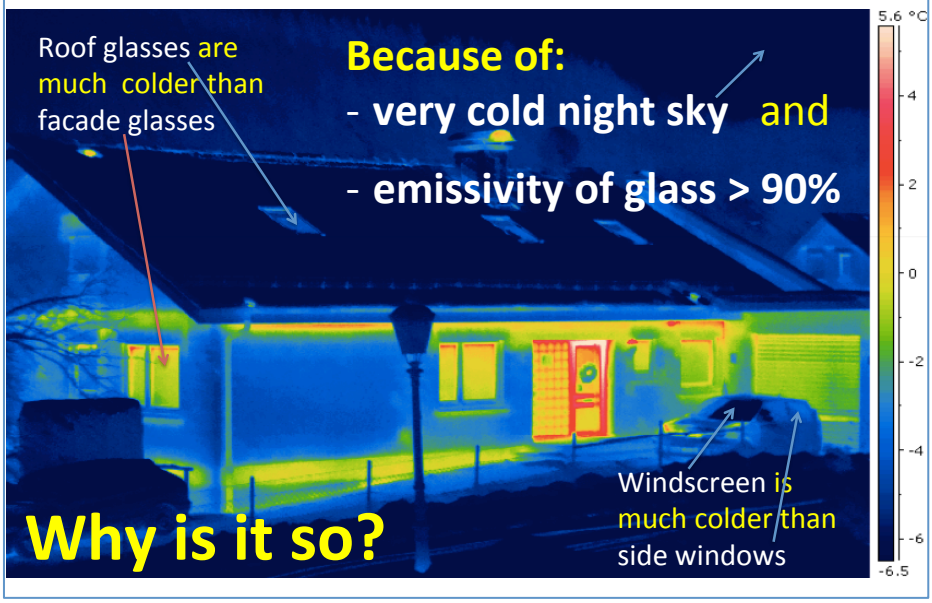
a) Butyls are not stressed = NO GAS LEAKAGE.

b) Glass-panes stays always flat = thinner glass could be used (less weight).



c) Outer reflection is not distorted = architects are satisfied…

2) Condensed water (frost) on outer glass



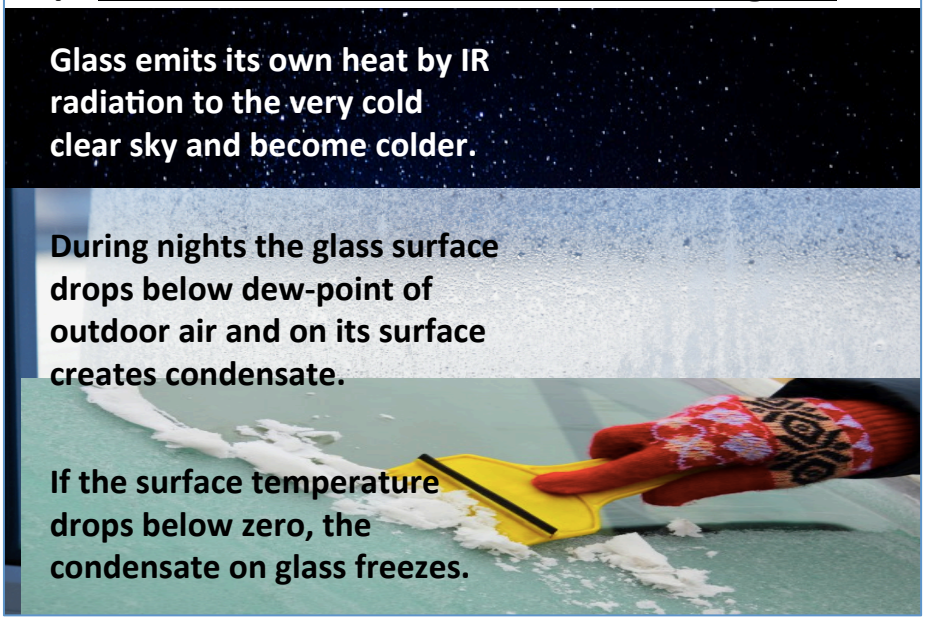
2) Condensed water (frost) on outer glass

Avoids: Low-E on outer glass surface

Reduces strongly the IR radiation of glass to the cold night sky; outer glass temperature doesn't drops below the due point, therefore the SURFACE STAYS DRY.

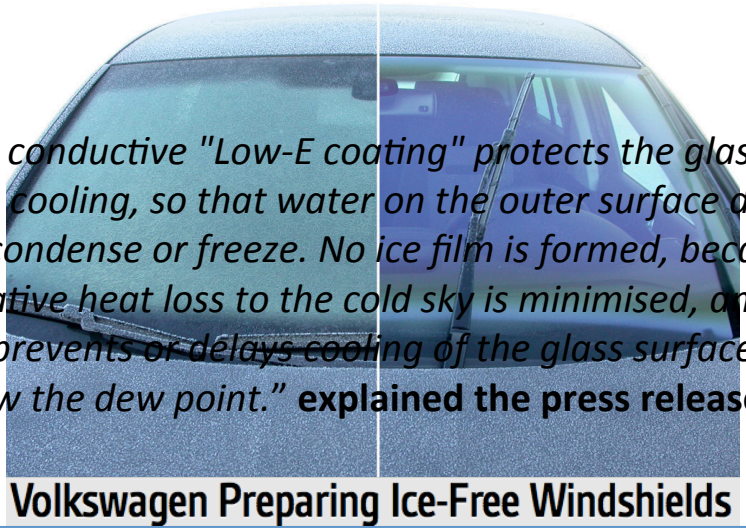
Glass-pane with low-e hard coating was proved:

2) Condensed water (frost) on outer glass



2) Condensed water (frost) on outer glass

Avoids: **Low-E on outer glass surface**

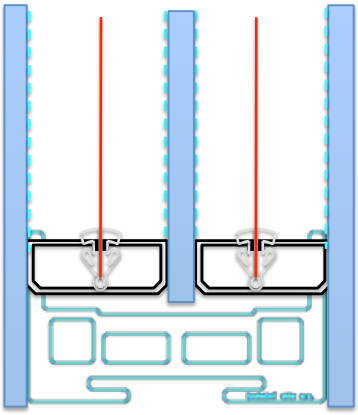


"The conductive "Low-E coating" protects the glass from cooling, so that water on the outer surface does not condense or freeze. No ice film is formed, because radiative heat loss to the cold sky is minimised, and this prevents or delays cooling of the glass surface to below the dew point." **explained the press release.**

Volkswagen Preparing Ice-Free Windshields

1) FRAMES for IG thicker > 56mm?

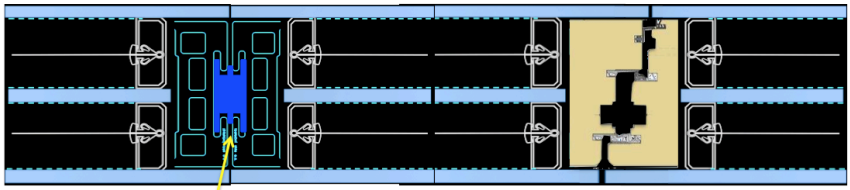
Option: FRAMELESS



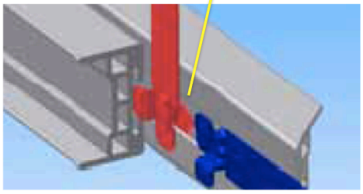
Fiberglass profile is integrated in the IG

1) FRAMES for IG thicker > 56mm?

FRAMELESS GLASS-WALLS with option:



openable elements



Best performance:

U_w < 0,29 W/m²K

Possible size up to: 3.2 x 6m

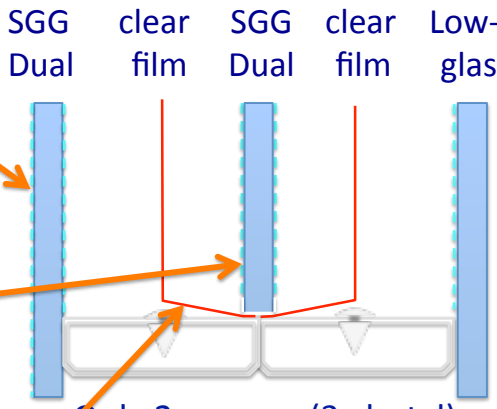
Super IG with benefits:

Outer glass is both sides low-e to avoid condense water

Middle glass is also both sides low-e to may use clear film

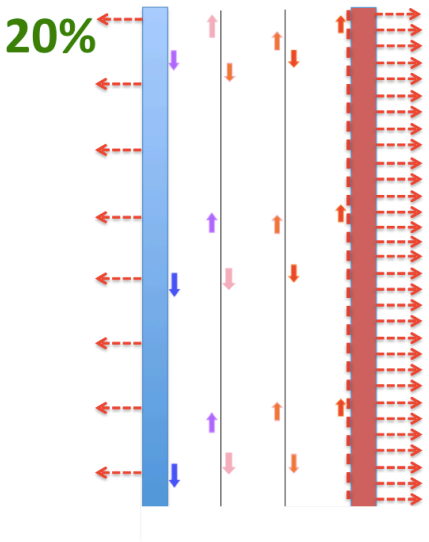
Max: 3.2 x 6m

mechanically stretched



- Only 2 spacers (3x butyl)
- Pressure equalized chambers
- **Spacer w. variable thickness**

POWER glass



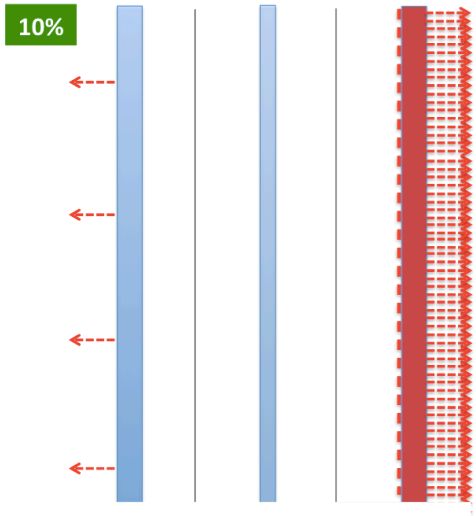
80%

Metalizing on interior glass is **electrically conductive** and has its resistance. It can therefore be connected to electricity.

The inner surface is low-e. Even if the glass get warm, **it doesn't radiate** its heat into the chamber.

Almost all the heat is transmitted radiatively into the interior.
But the balance 80/20% is valid only for 3-chamber IG's.

POWER glass



90%

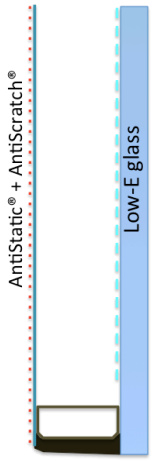
Especially by heating glass has sense to invest into 4-chamber IG (U_g = 0,2 W/m²K).
The higher price will be due the higher efficiency quickly payed back.

USING OF HEATING GLASS:
The most enjoyable way, how to get warm (glass radiates over the entire body surface)

+ saving energy during the day => heats only where and when is needed (zone heating).

Insulating MONOglass 1 glass pane only + film(s)

U_g > 0,9 ONE chamber solution

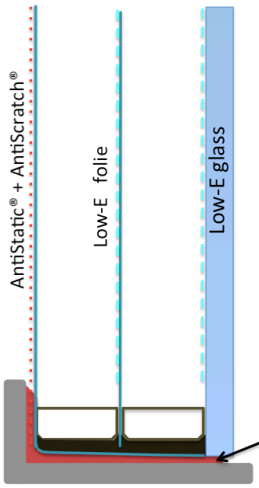


NO risk of condensed water by opening

> 10mm only

Insulating MONOglass

Ug = 0,5 Double chamber solution



Use: **Anti-teroristic glass façade**

In case of outdoor explosion catch the film all splitters and avoid hurting people inside the building.

With gluing MONOglass directly into frame is the film very well fixed.

Insulating MONOglass for GLASS-ROOFS

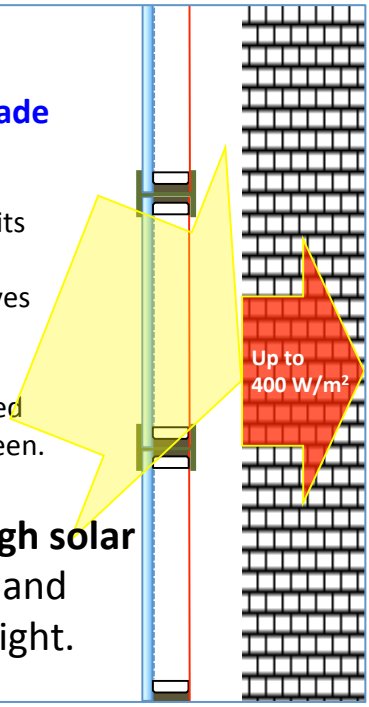
Thanks extremely toughness of the film is solution useful also for roof with prestressed glass (load of snow):

Insulating MONOglass

Mostly used as front-built glass façade

Several glass panes built on themselves doesn't cause static problem if they keep its flatness.
Inflating or deflating by MONOglass involves just the film. Not the glass – it keeps flat.

Therefore the Mono-glasses can be cladded on each other with simple H-profile between.



Sunny days in winter = **very high solar gain** => absorbed into the wall and accumulate heat for the cold night.

Insulating MONOglass

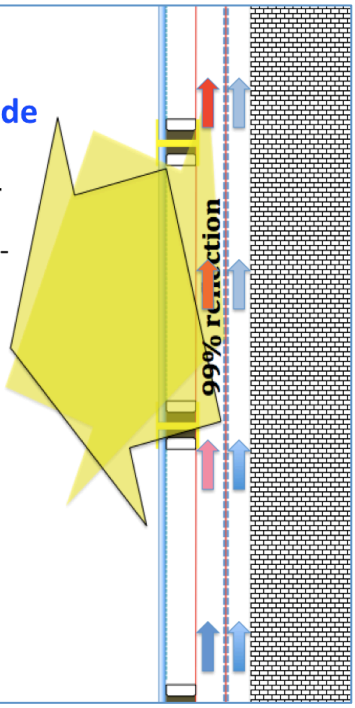
Mostly used as front-built glass façade

Solar protection (in two levels):

1) Between wall and façade is "mirror iris" - non transparent both-side coated film for perfect **reflection of visible and IR light.**

Control of the iris (up and down) is full automatic (depended on temperatures)

3) Ventilation in gap between Mono-glass and wall is also controlled automatically.
ON = overheating protection
(OFF = insulating chamber)



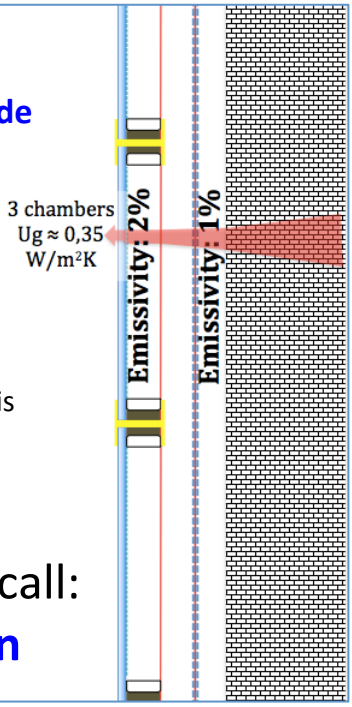
Insulating MONOglass

Mostly used as front-built glass façade

Nights or cloudy cold days:

The "mirror iris" is effectively used also in nights or cloudy cold days to increase the insulation performance.

Due the both-side low-e silver coating on his surface is possible to create 3 insulating chambers.



This complete solution we call:

Transparent wall insulation