



GUARDIAN

Glass • Automotive • Building Products

UŠTEDA ENERGIJE SA STAKLOM

BUILD WITH LIGHT™



Sadržaj

- Korporacija Guardian Industries
- Staklo kao materijal
 - Tehnologija proizvodnje premaza: Pirolitički vs. Magnetron
 - Gubitak energije kod termo-izolacionog stakla
 - Niskoemisiono staklo: CLIMAGUARD[®] PREMIUM
 - Multifunkcijska stakla: SUNGUARD[®]
 - Troslojno staklo. Izazovi, problemi
 - Reference



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Korporacija Guardian Industries

Istorija



1932: Poceo kao mali proizvođač automobilskih vjetrobrana u Detroit-u /Drzava Michigan (USA)



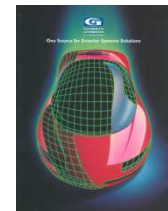
1970: Otvorena prva GUARDIAN float linija u Carleton / MI (USA)

1981: Otvorena prva GUARDIAN float linija u Evropi (LUXGUARD I)

Guardian Danas - ima više od 21.000 zaposlenih u 18 zemalja i na 5 kontinenata
- sa 30 float linija treci-najveci proizvođač stakla na svijetu

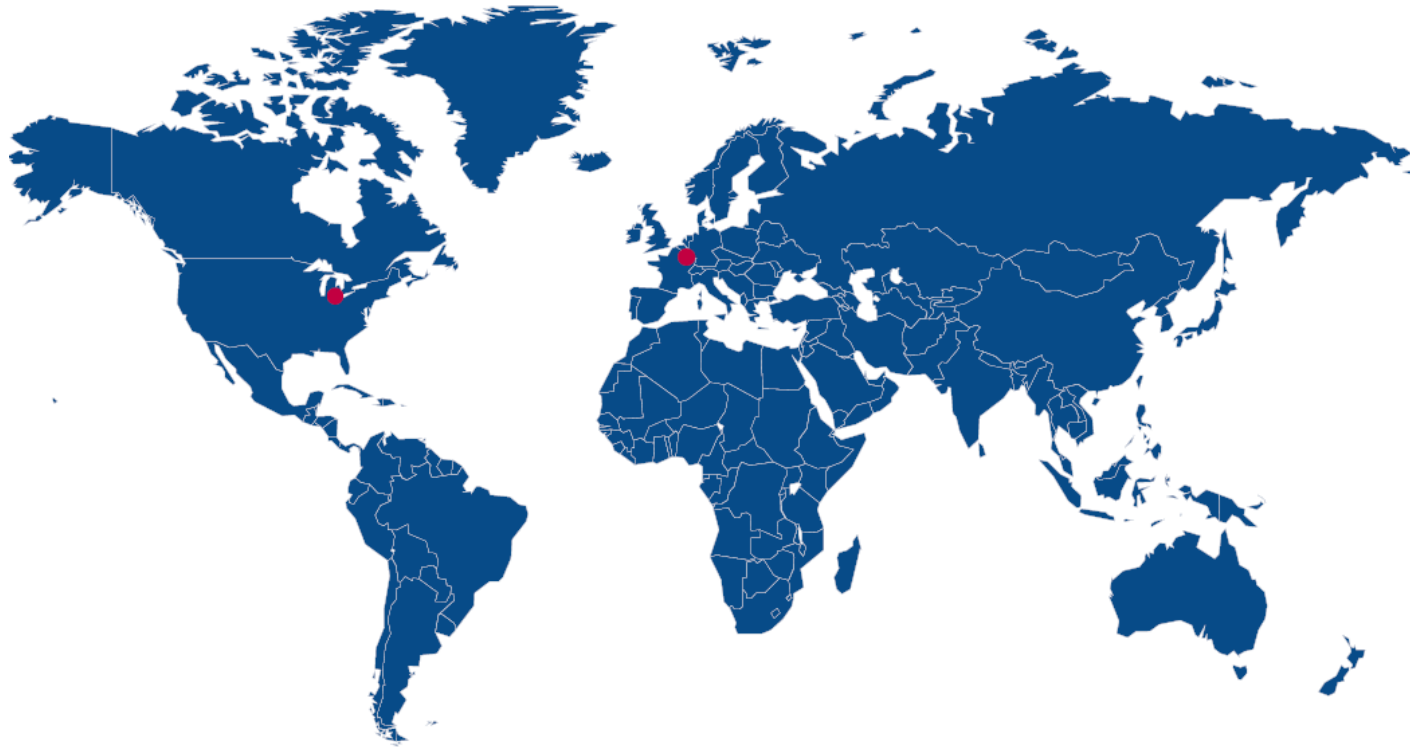
Proizvodi:

- Staklo za arhitekturnu i automobilsku industriju
- Plastični i metalni "trim" sistemi za automobilsku industriju
- Staklena vuna izolacioni proizvodi



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Guardian-ova Sjedišta



World Headquarter

- Auburn Hills / Michigan

European Headquarter

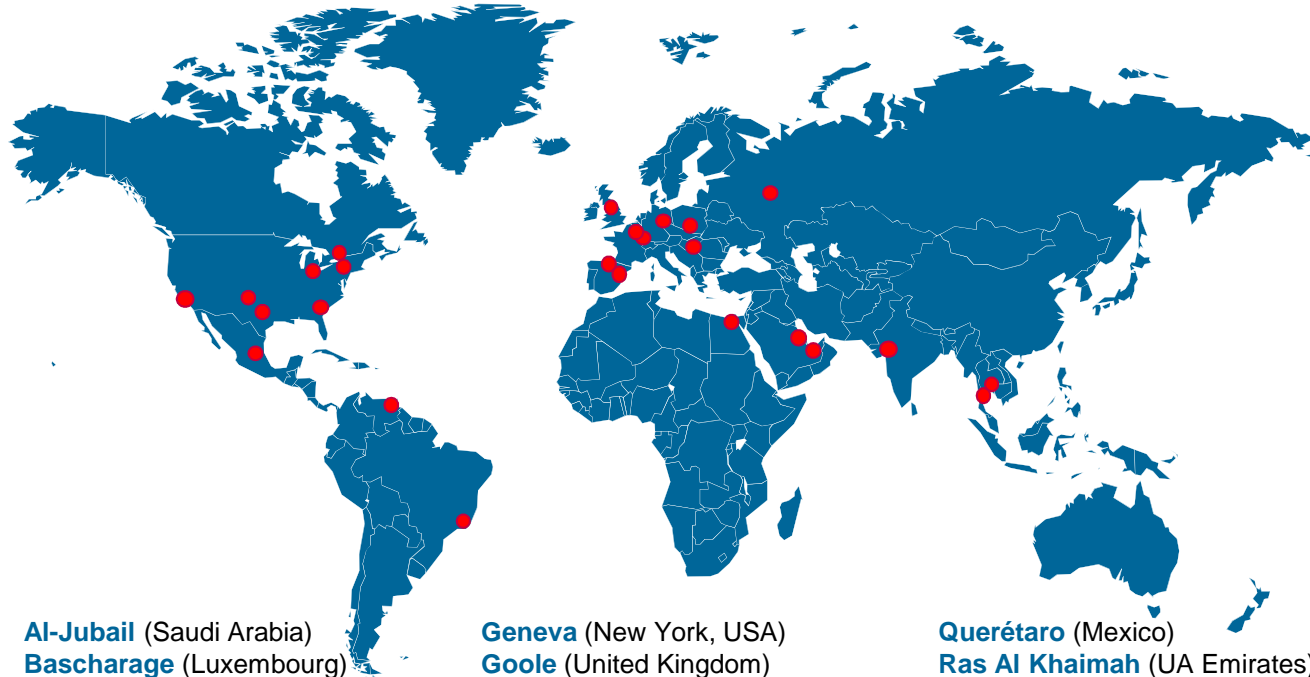
- Dudelange / Luxembourg

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About Guardian

Guardian-ove Linije Float Stakla



Al-Jubail (Saudi Arabia)
Bascharage (Luxembourg)
Cairo (Egypt)
Carleton (Michigan, USA)
Corsicana (Texas, USA)
Częstochowa (Poland)
DeWitt (Iowa, USA)
Dudelange (Luxembourg)
Floreffe (Pennsylvania, USA)

Geneva (New York, USA)
Goole (United Kingdom)
Gujarat (India)
Kingsburg (California, USA)
Llodio (Alava, Spain)
Maturin (Venezuela)
Nong Khae (Thailand)
Orosháza (Hungary)
Porto Real (Rio de Janeiro, Brazil)

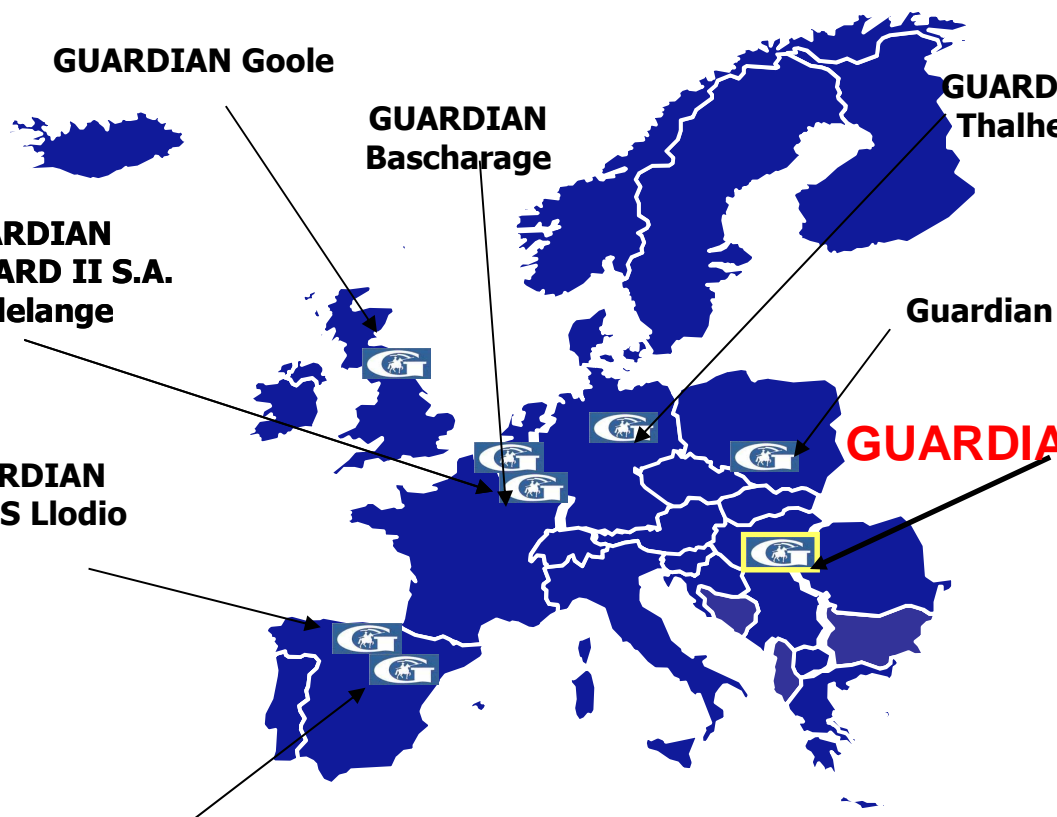
Querétaro (Mexico)
Ras Al Khaimah (UA Emirates)
Rayong (Thailand)
Ryazan (Russia)
Richburg (South Carolina, USA)
Thalheim (Germany)
Tudela (Navarra, Spain)

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Vise od 21.000 zaposlenih, u 18 zemalja, na 5 kontinentata.

Sa vise od 30 float linija, Guardian je treci najveći proizvođač ravnog stakla u svijetu, ali prvi po kapacitetu proizvodnje fabrikovanih proizvoda



GUARDIAN Goole

GUARDIAN LUXGUARD II S.A. Dudelange

GUARDIAN GLASS Llodio

GUARDIAN Tudela

GUARDIAN Bascharage


GUARDIAN Thalheim

Guardian Czestochowa

GUARDIAN Orosháza Kft.



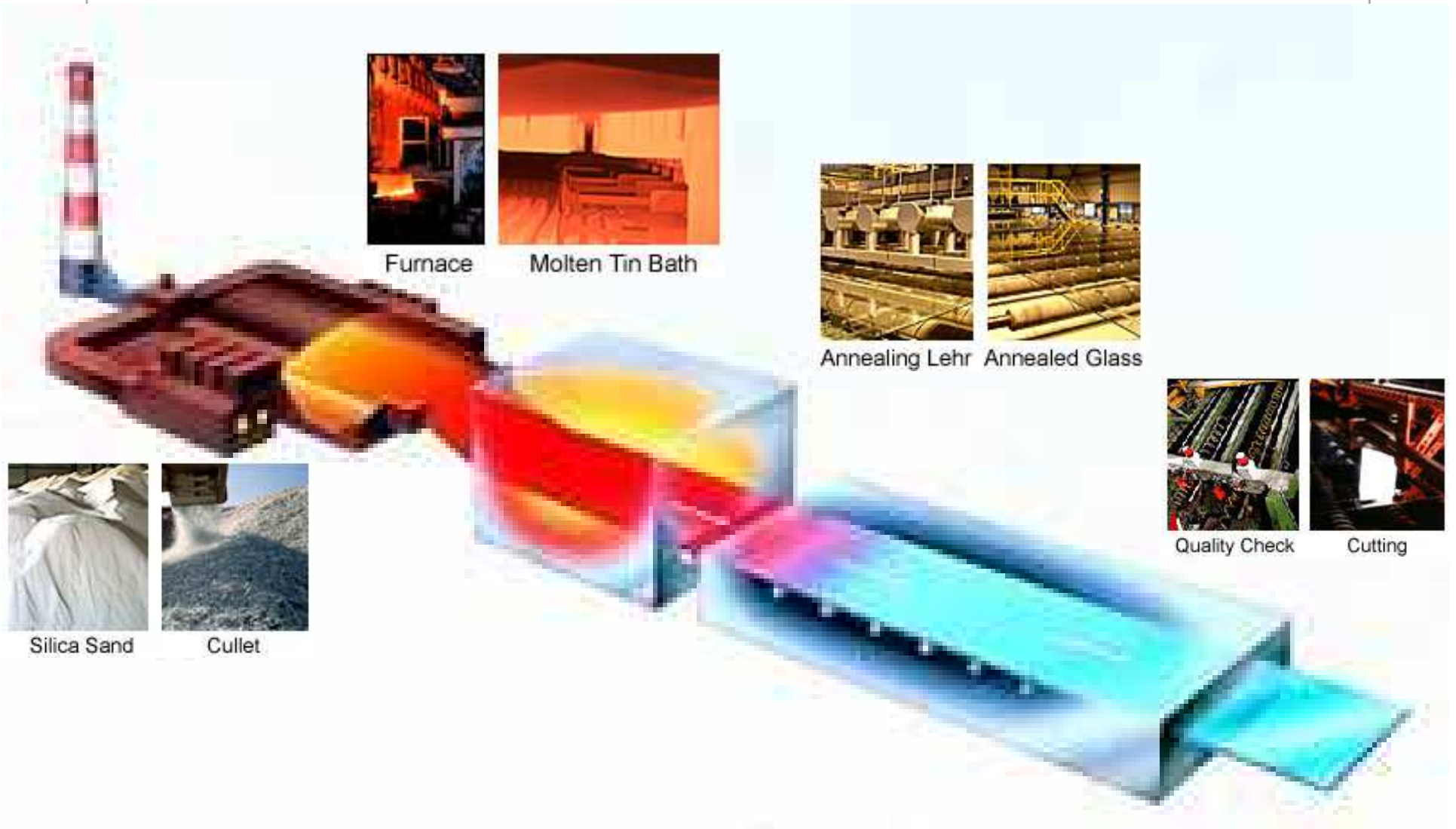
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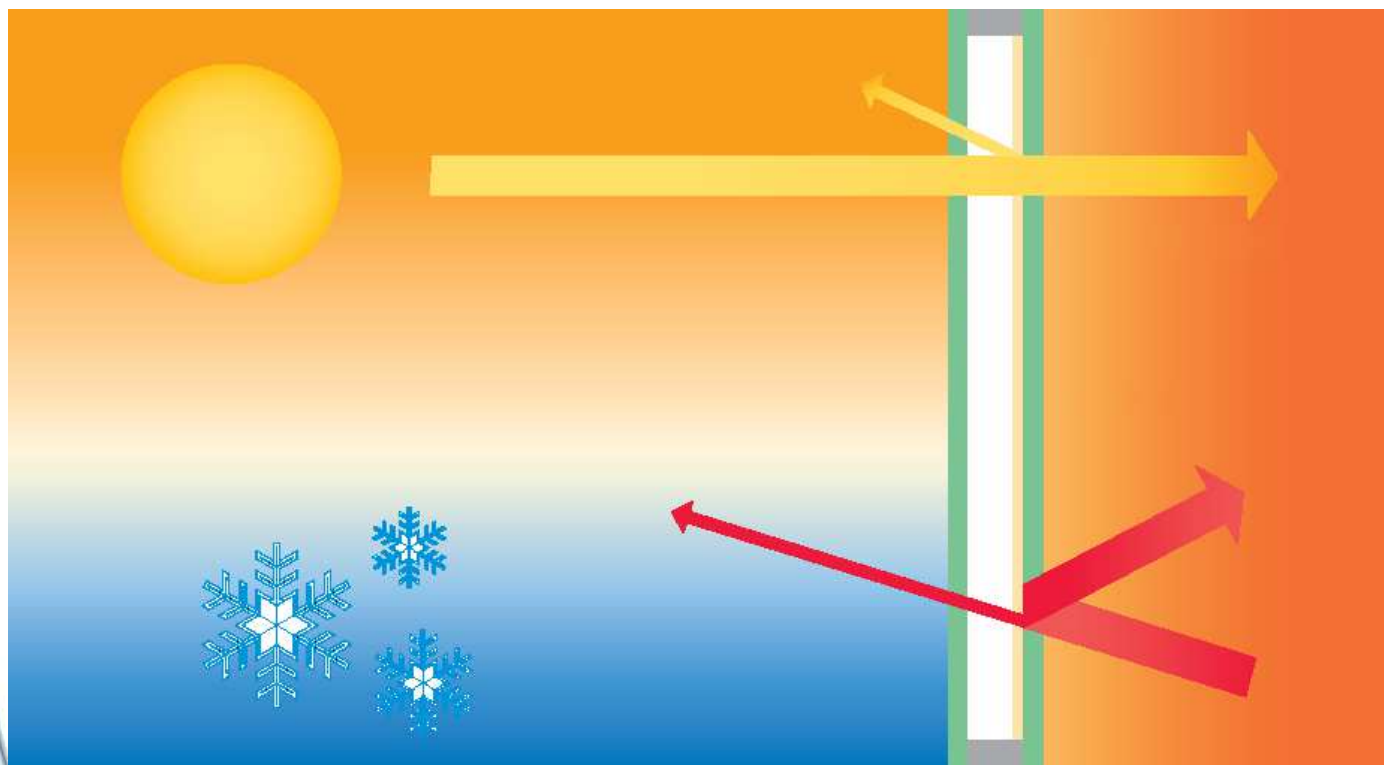
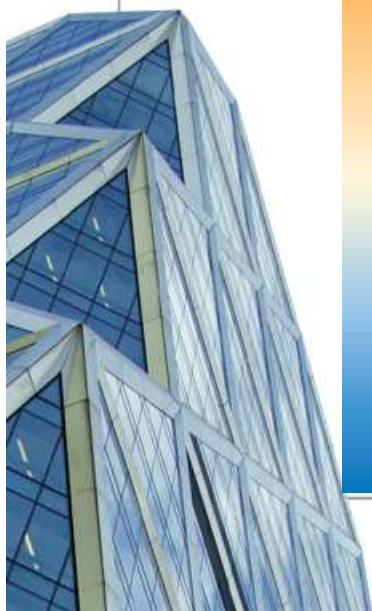
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Staklo kao materijal



Staklo kao građevinski materijal

Sunčeva energija i energija za grijanje



Kako promijeniti svojstva Float stakla?

- **Staklo bojeno u masi**
 - Plavo, zeleno, sivo...
- **Staklo sa premazom**
 - Različite tehnologije...



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VAŽNE DEFINICIJE

Propusnost svjetlosti LT [%]

Propuštena vidljiva svjetlost
(spektralni opseg: 380...780nm)- EN 410

Refleksija svjetlosti LR [%]

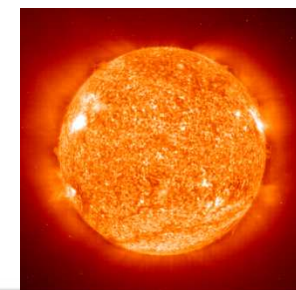
Direktno reflektovana vidljiva svjetlost
(spektralni opseg: 380...780nm)- EN 410

Ukupna propusnost sunceve energije SOLARNI FAKTOR (g-vrednost)

Direktna propusnost sunceve energije plus sekundarni prenos toplote (iz apsorpcije) ka unutra (spektralni opseg: 300...2500nm)- EN 410



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VAŽNE DEFINICIJE

Propusnost toplote Ug-vrijednost (vazeca norma po EN 673 standardu, bivsi K-faktor po Nemackoj DIN- normi)

Toplotna provodljivost stakla u opsegu dugotalasnog zračenja (spektralni opseg: 5000...50000nm.)-EN673

Ug = koeficijent termoprovodljivosti za staklo

Uf = koeficijent termoprovodljivosti za ram

Uw = koeficijent termoprovodljivosti za celi prozor ili fasadni element



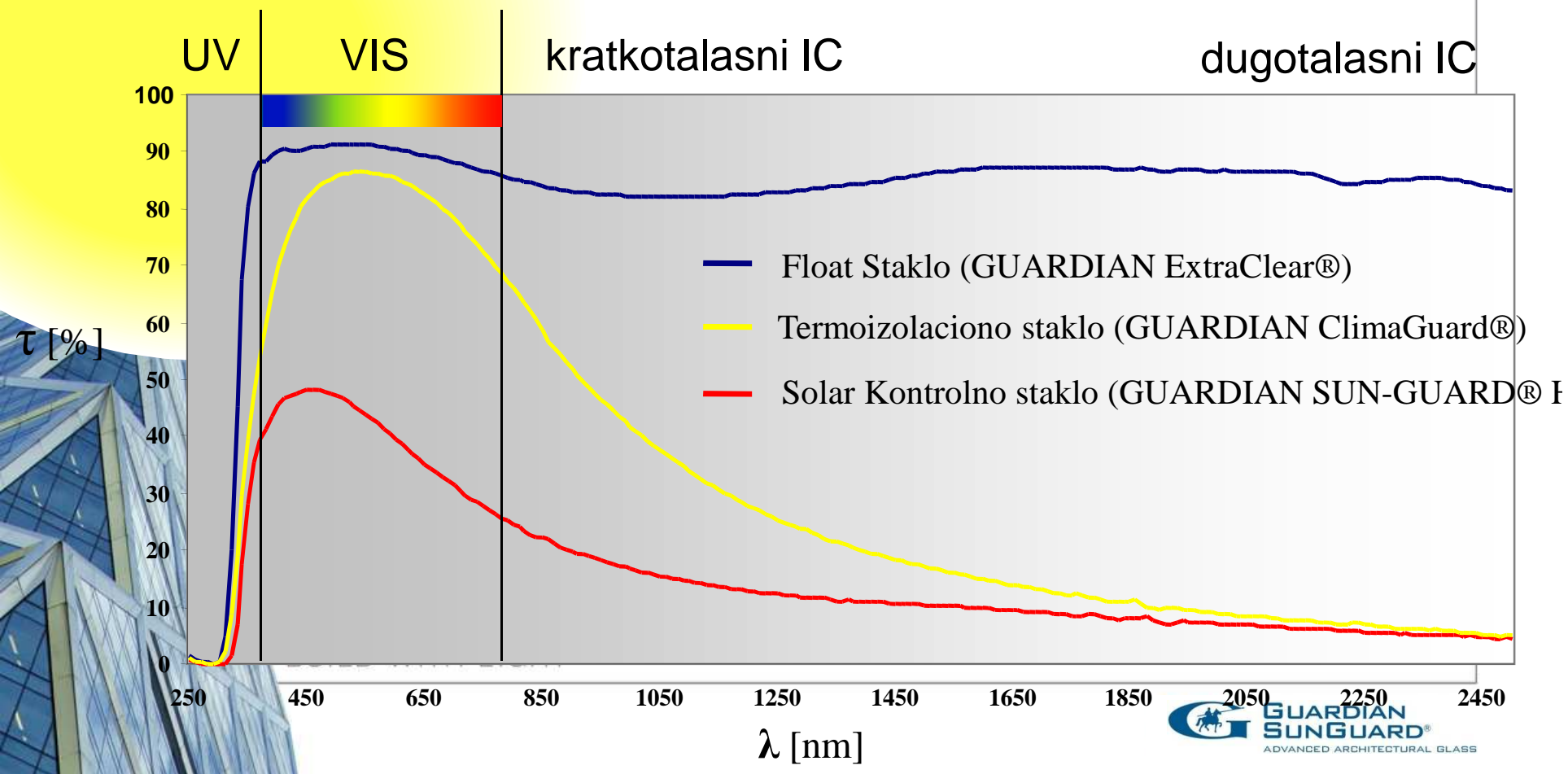
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Spektralni podaci arhitekturnog stakla

Propusnost kao funkcija duzine talasa (solarno zracenje)

solarna energija



Današnje Tehnologije izrade Premaza

Tvrdi premaz
“pyrolytic”

- Hemiski način nanošenja premaza na staklo

Mekani premaz
“Magnetron”

- Fizički način nanošenja premaza na staklo
(Magnetron Sputtering)

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Današnje tehnologije izrade premaza



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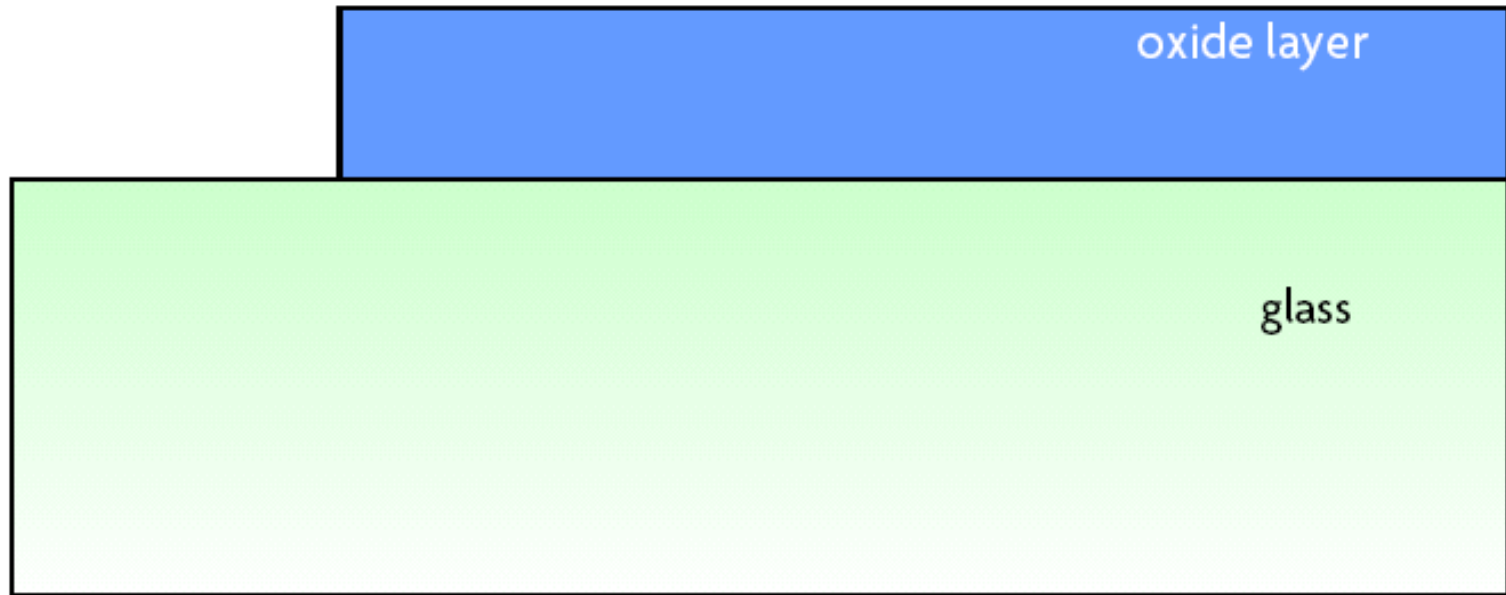
- Limitirane performanse i izbor



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Pyrolytic Coating



dielectric oxide-single layer (e.g. SnO_x doped with F)

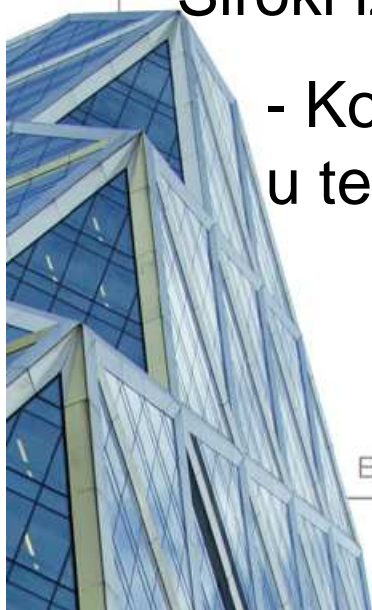
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Današnje tehnologije izrade premaza

Meki premaz “magnetron”

- Fizički princip nanošenja premaza na staklo (Magnetron Sputtering)
- Višeslojni, ekstremno tanki slojevi različitih metala, -oksida, -nitrida.
- Široki izbor performansi, boja
- Korištenje **ISKLJUČIVO** u termo-paketu!

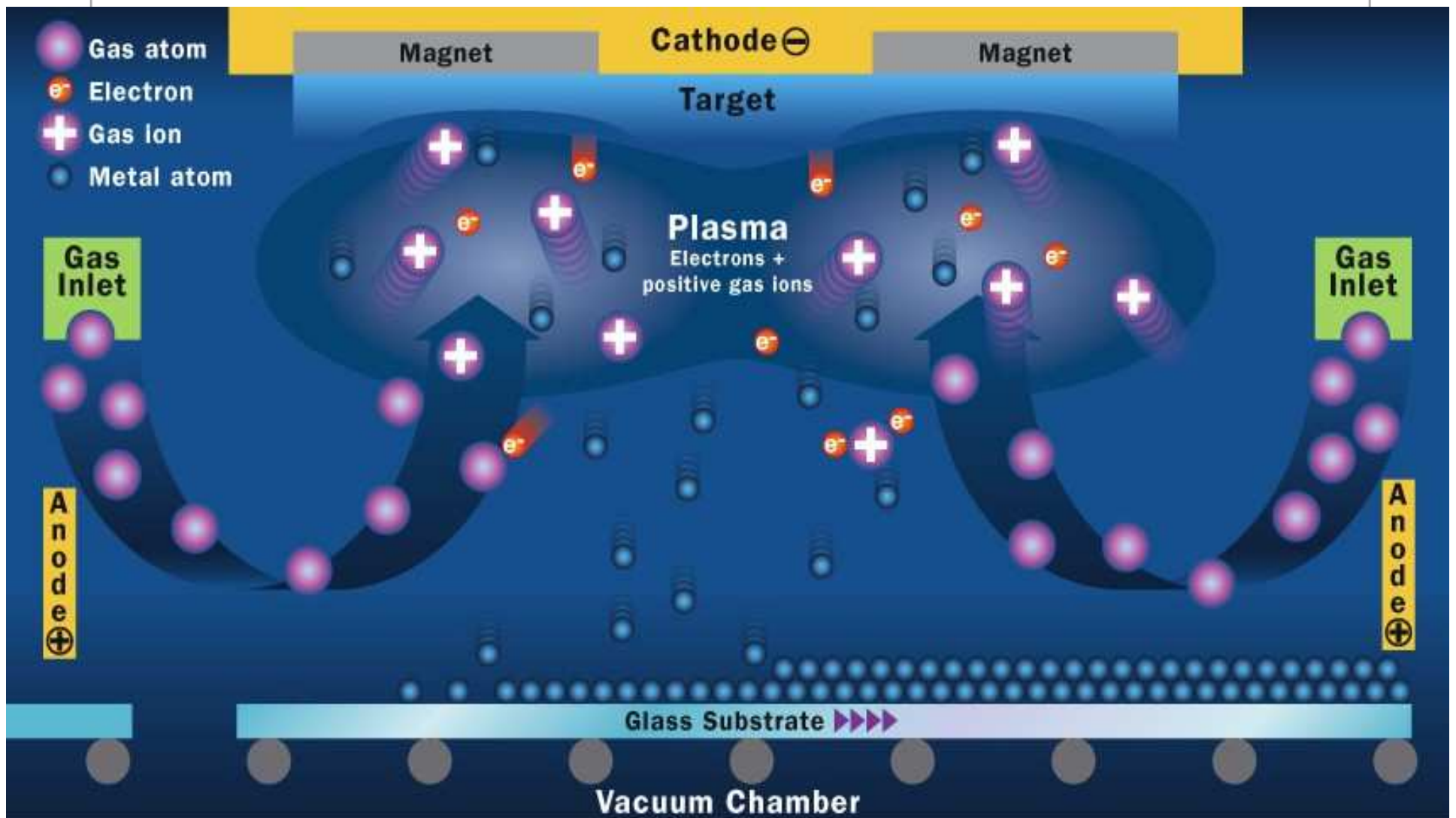


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Tehnologija Proizvodnje

**Magnetron Sputtering Process (“Fizički”
Proces), u specijalnim vakum komorama**

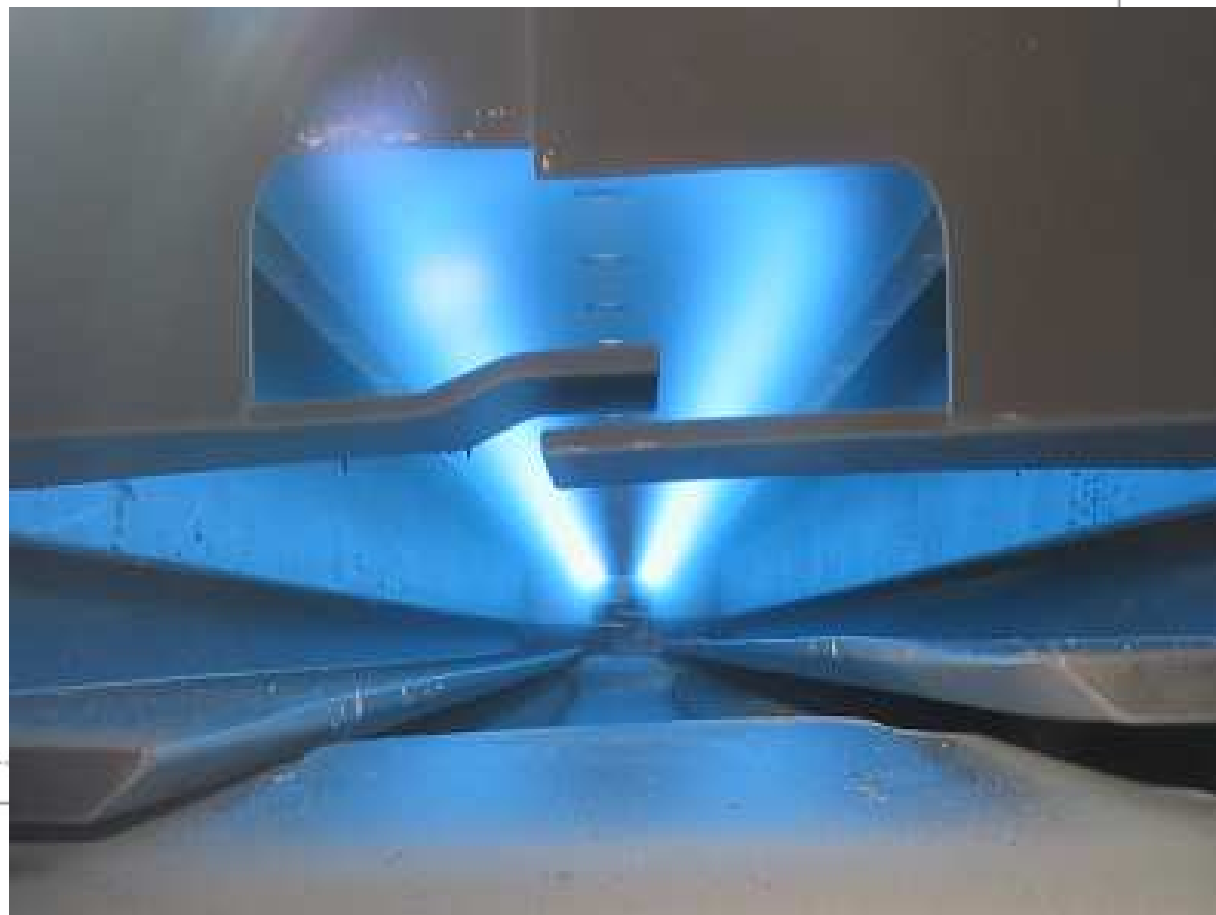


Technologija - GUARDIAN

- **SAMO Magnetron** premazi
- **Solarno i Termalno kontrolna stakla**
- **Sa višeslojnim sistemom**



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Stakla sa premazom: Segmentacija

- Za stambenu gradnju: **ClimaGuard®**



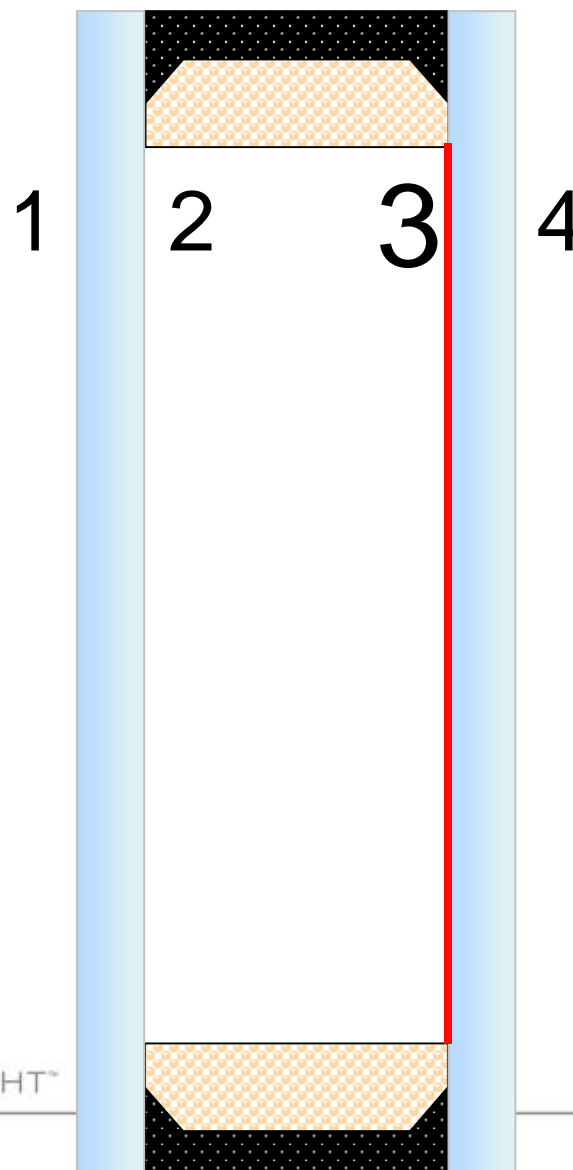
- Za komercijalnu gradnju (projekte): **SunGuard®**



« Pozicije » u Termo-Paketu



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Nisko-Emisiono staklo / Low-E

4_16 Ar_4, premaz na poz. 3; EN 673

- ClimaGuard Neutral 70 1.4 W/m²K
- ClimaGuard N 1.2 W/m²K
- ClimaGuard Premium 1.1 W/m²K
- ClimaGuard Solar 1.0 W/m²K
- ClimaGuard 1.0 1.0 W/m²K

4_18 Ar_4_18 Ar_4, premazi na poz. 2 i 5

- ClimaGuard Premium **0.5 W/m²K**

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Nisko-Emissiono staklo



CLIMAGUARD® PREMIUM

THERMAL INSULATING GLASS WITHOUT COMPROMISES



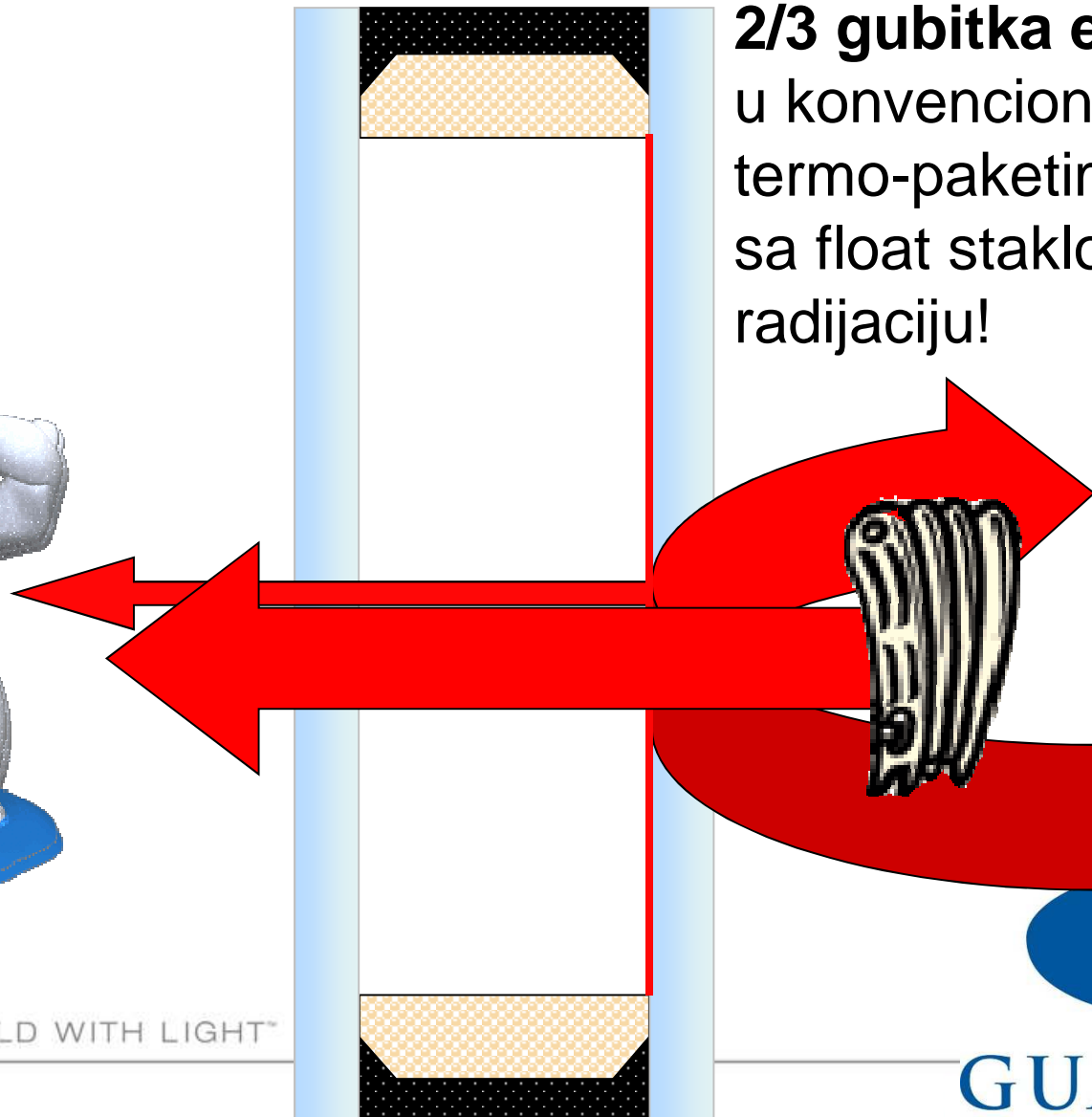
Pregled U_g -vrijednosti

- Stara DIN-norma: „k-faktor”
- Vazeća EN 673 norma: „**U-vrijednost**”

Prva ploča termo-paketa	Gasni prostor		Druga ploča termo-paketa	Pozicija premaza	Ug-vrijednost (W/m ² K)	Propusnost svjetlosti (%)
	Širina "lajsne"	Gas				
4	12	zrak	4	-	2.9	81
4	16	zrak	4	-	2.7	81
4	12	argon	4	-	2.7	81
4	16	argon	4	-	2.6	81
4	16	zrak	4 ClimaGuard Premium	3	1.4	79
4	12	argon	4 ClimaGuard Premium	3	1.3	79
4	16	argon	4 ClimaGuard Premium	3	1.1	79
4	12	kripton	4 ClimaGuard Premium	3	1.1	79
4	20	kripton	4 ClimaGuard Premium	3	1.1	79
4 ClimaGuard Premium	16	argon	4 ClimaGuard Premium	2+3	1.1	78
TROSLOJNO STAKLO						
4 ClimaGuard Premium	14 + 14	argon	4 ClimaGuard Premium	2+5	0.6	70

Prenos energije u Termo-Izolacionim paketima = **Radijacija** + Konvekcija + Kondukcija

2/3 gubitka energije
u konvencionalnim
termo-paketima 4-16-4
sa float staklom kroz
radijaciju!



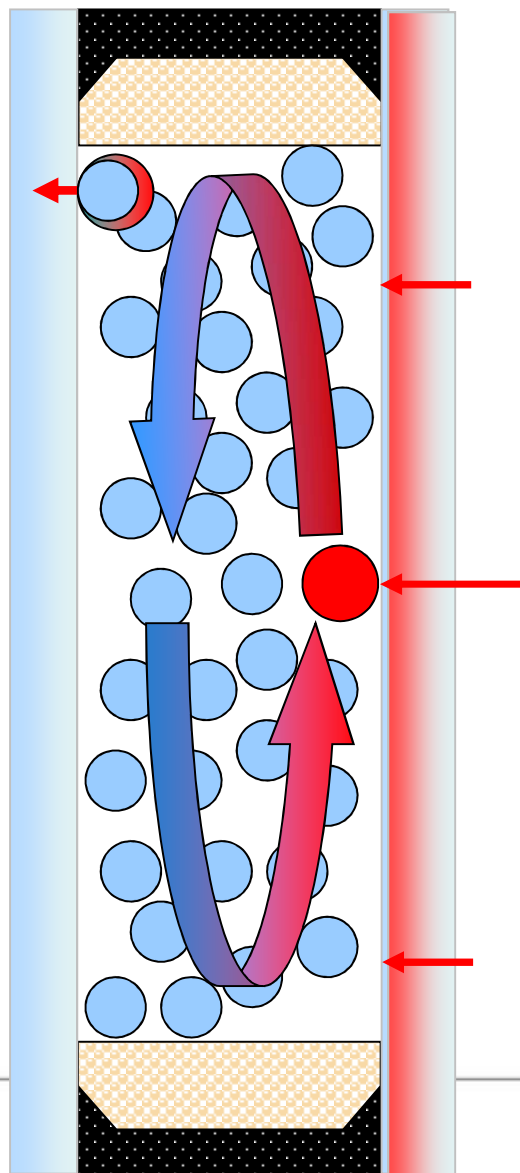
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Prenos energiju u Termo-Izolacionim paketima = Radijacija + **Konvekciija** + Kondukcija



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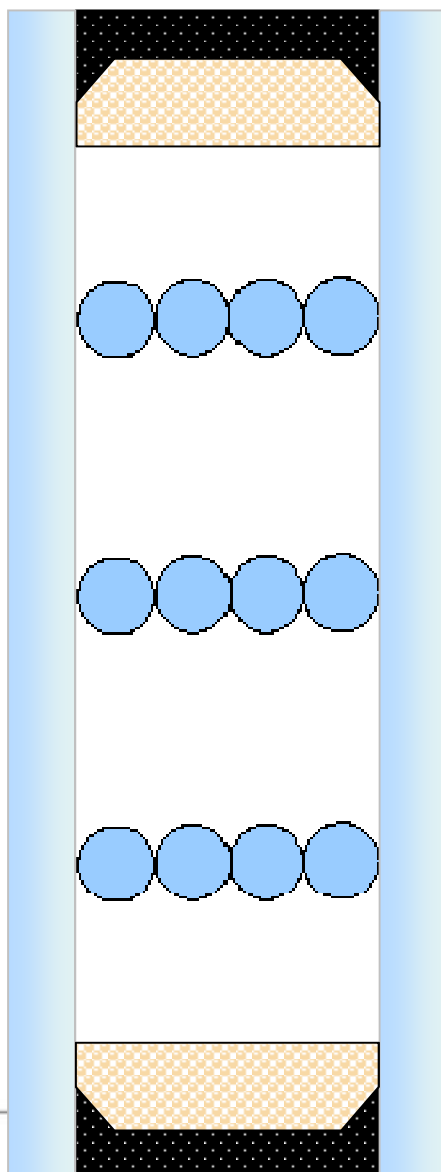
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Prenos energiju u Termo-Izolacionim paketima = Radijacija + Konvekcija + **Kondukcija**



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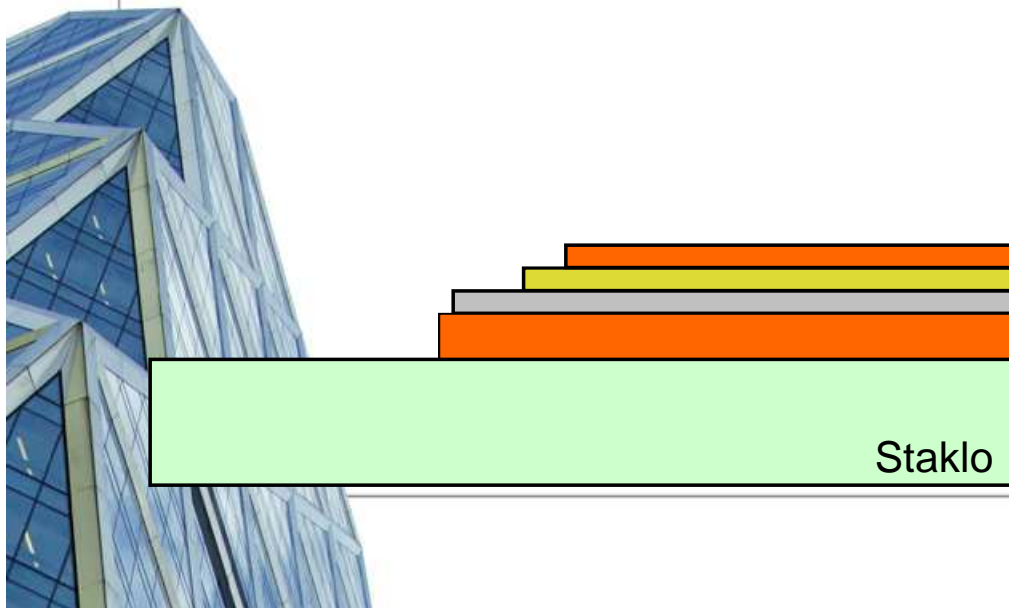


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Nisko-Emisiono staklo – Tehnologija Proizvodnje

- Physical Vapor Deposition (Magnetron Sputtering) – “Fizički Proces”
- Višeslojni, ekstremno tanki slojevi različitih metala, - oksida, -nitrida. Funkcionalni sloj je SREBRO.
- Totalna debljina oko 80 nanometara, 2500-puta tanja nego vlas prirodne kose!
- „Meki” premaz: **Isključiva upotreba u termo-paketu!**



TROSLOJNO STAKLO



- Niski Ug-vrijednost
- Vanjska površina stakla hladna
- Često se pojavi kondenzacija na poz. 1

Odgovor na vanjsku kondenzaciju:

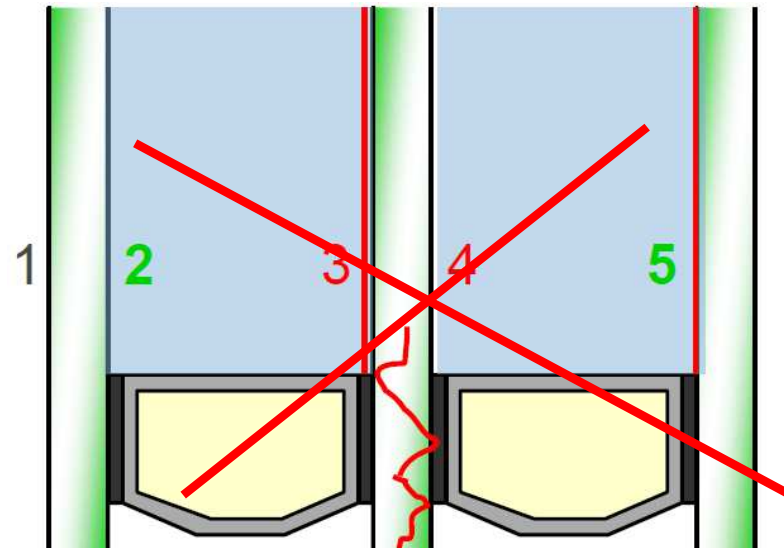
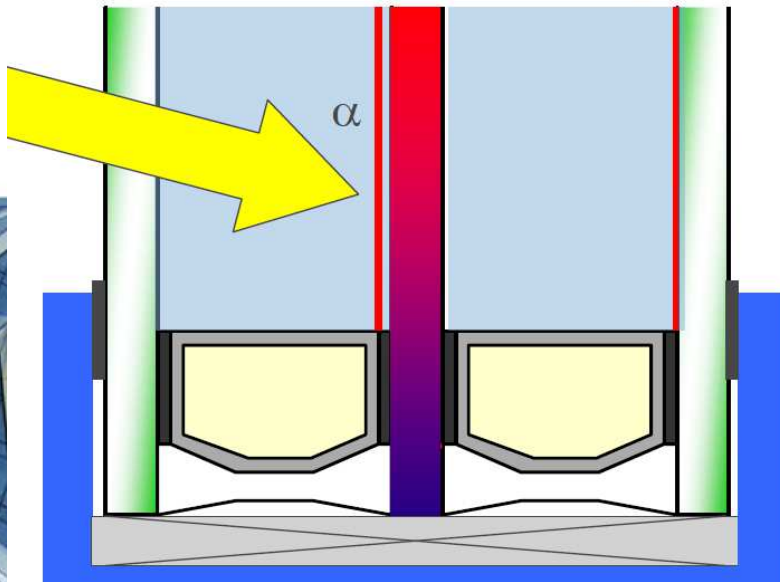
ClimaGuard[®] Dry



TRIPLE GLAZING ATTENTION!

Results

- Middle pane absorbs solar irradiation – can lead to thermal breakage



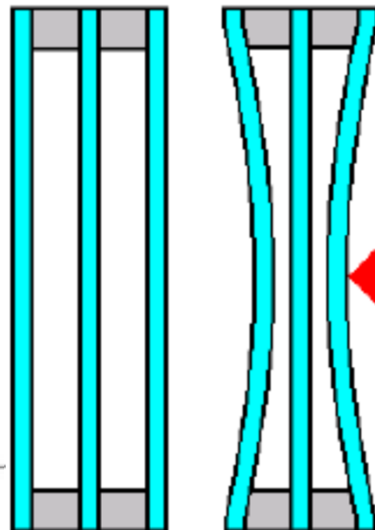
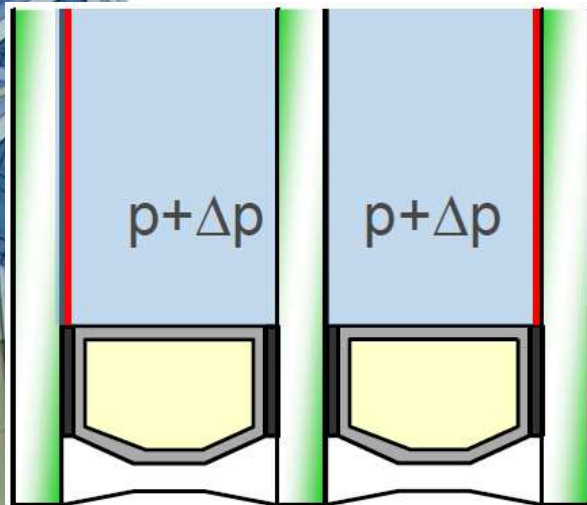
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Avoid coating in pos. 3 or 4!

TRIPLE GLAZING ATTENTION!

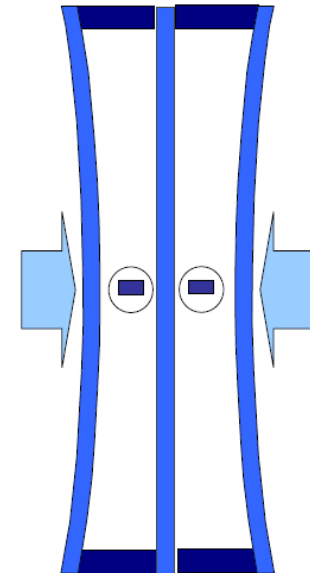
Climatic load effects:

- Breakage
- too much bending: optical distortion in reflection
- Too big loads given to the sealing => shorter lifetime



TRIPLE GLAZING ATTENTION!

Results



Guardian
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Glass panes might touch in the middle

TRIPLE GLAZING ATTENTION!

Different climatic loads!

too small: shorter side less than 50 cm

solution: try to avoid it

Middle pane should be tempered – due to thermal stress





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ADVANCED ARCHITECTURAL GLASS

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SUNGUARD® SOLAR

SUNGUARD® HIGH PERFORMANCE

SUNGUARD® HIGH SELECTIVE

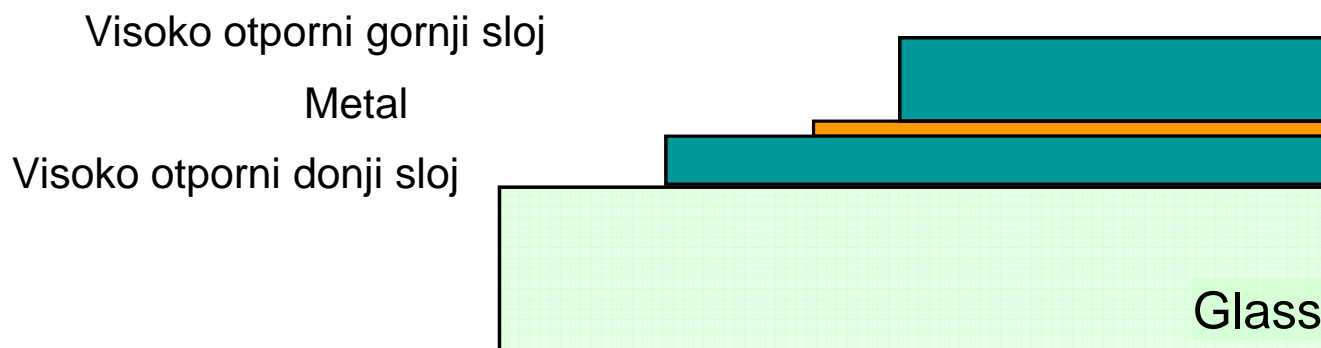


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Glass Architecture. Building Progress.

Solar Control Glass

SUNGUARD® SOLAR

SOLAR CONTROL FOR CREATIVE APPLICATIONS



- visoko otporni magnetron premaz
- skidanje premaza nije obavezno
- Može se kaliti, savijati, laminirati uz PVB-foliju, moguća sito-tisak sa keramičkim bojama
- dostupno u više boja i odličnim tehničkim performansama na ExtraClear Float staklu
- radi dobijanja boljih tehničkih performansi, potrebno ga je kombinovati sa nisko-emisionim staklom



Solar Control Glass

SUNGUARD® SOLAR

SOLAR CONTROL FOR CREATIVE APPLICATIONS

Propusnost Svjetlosti: **6 ... 60 %**

Refleksija Svjetlosti: **7 ... 43 %**

Totalna Transmitovana Energija (Solarni Faktor) do:
10 %

Tipovi na **ExtraClear™**

Neutral 67
Light Blue 52
Silver Grey 32
Royal Blue 20
Silver 20
Silver 08

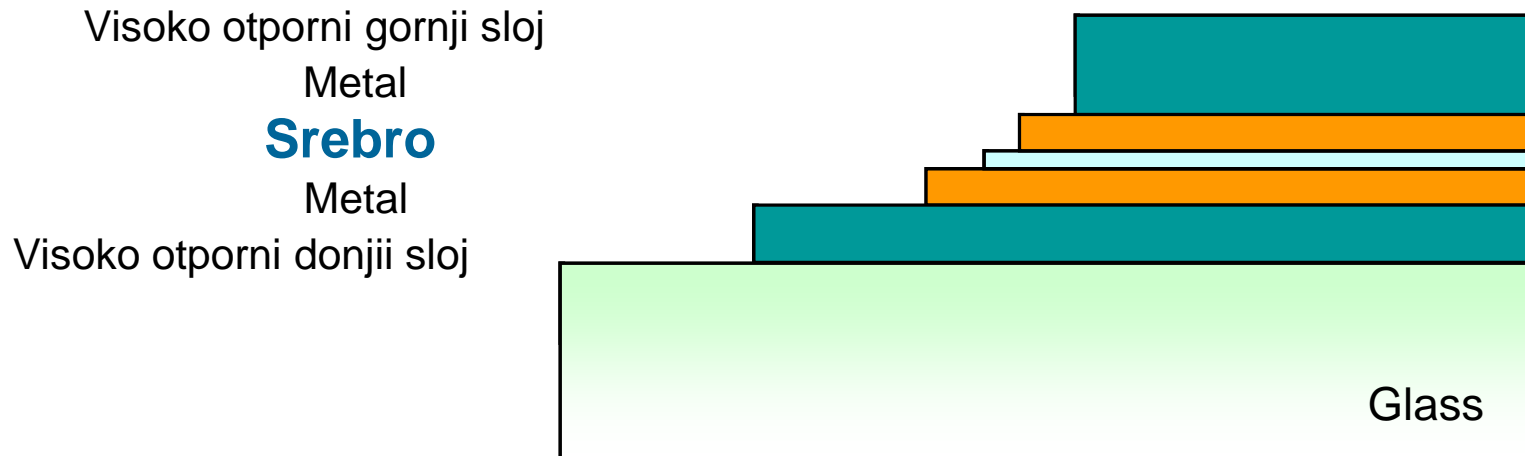
BUILD WITH LIGHT™



SUNGUARD® HP

HIGH PERFORMANCE SOLAR CONTROL

Solarna kontrola i termoizolacija u jednom premazu



- otporni magnetron premaz sa funkcionalnim metalnim slojevima
- skidanje premaza nije obavezno ako se koristi testirani materijal*
- Može se kaliti, savijati, laminirati uz PVB foliju, moguća sito-tisak sa keramičkim bojama
- širok izbor boja I performansi na ExtraClear float staklu

BUILD WITH LIGHT™



Solar Control Glass

SUNGUARD® HP

HIGH PERFORMANCE SOLAR CONTROL

Propusnost Svjetlosti: **28 ... 62 %**

Refleksija Svjetlosti: **7 ... 44 %**

Totalna Transmitovana Energija (Solarni Faktor) do:
26 %

Ug-vrijednost: do: **1,1 W/m²K*** (EN 673)

* lajsna: 16 (15) mm punjeno Argonom

Tipovi na **ExtraClear™**

Light Blue 62/52

Neutral 60/40

Neutral 52/41

Neutral 50/32

Silver 43/31

Neutral 41/33

Silver 35/26

Royal Blue 41/29

Amber 41/29

Bright Green 40/29

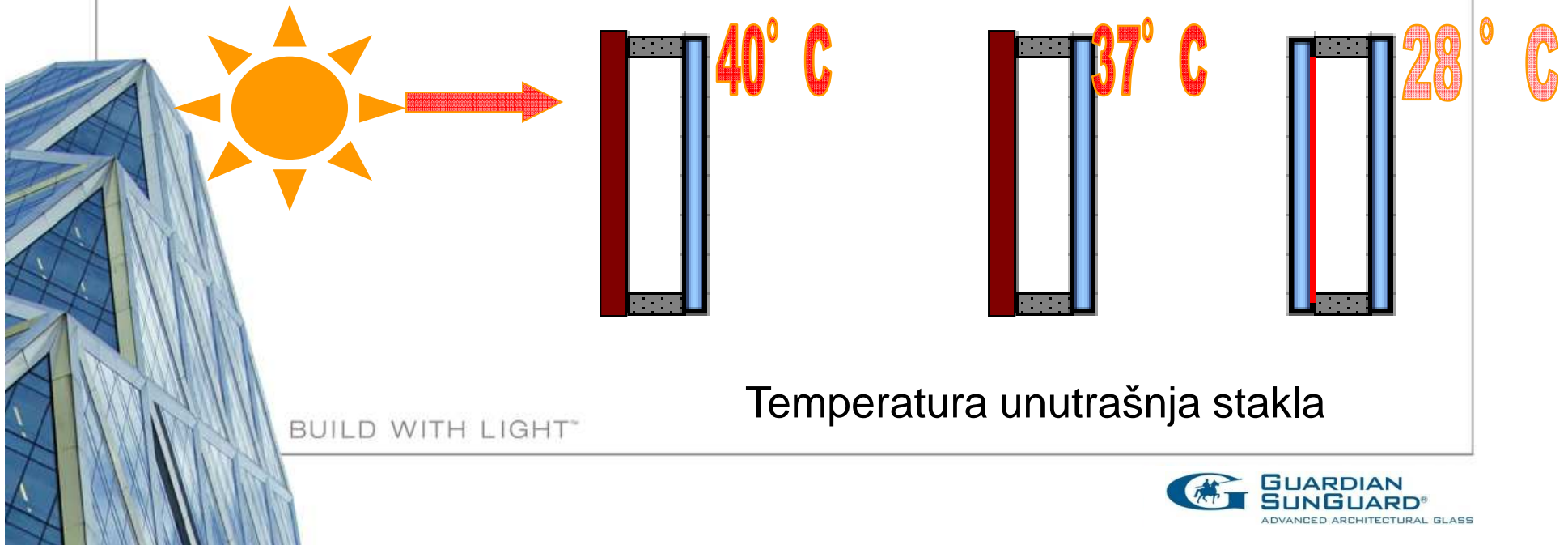
Bronze 40/27

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Poređenje

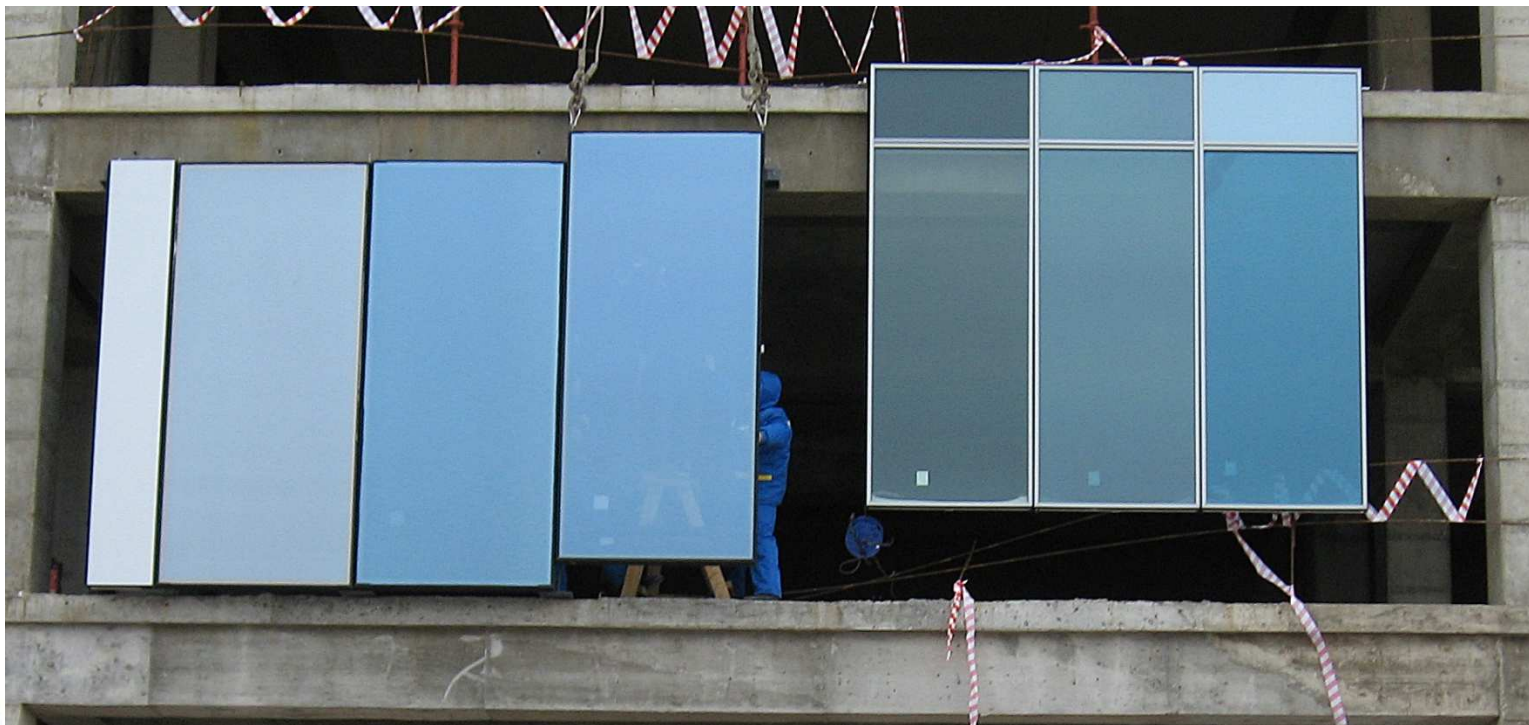
4 mm_16_4 mm

	Piroliticko bronz bojeno u masi, poz.1	Piroliticko bronz bojeno u masi, poz.2	Bronz bojeno u masi	SunGuard HP Bronze 40
Transm. svjetlosti	24%	24%	56%	40%
Solarni Faktor (g)	37%	39%	60%	27%
Absorpcija energije	41%	<u>55%</u>	38%	47%
Ug-vrijednost (W/m ² K)	2.8	2.7	2.8	1.1
Premaz na poz.	1	2	-	2



Colour Rendering

Pogled iz vana



Magnetron-premaz na
ExtraClear™ float staklu

Pirolitčni premaz na
staklu bojeno u masi

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Colour Rendering

Pogled iznutra



Pirolitичni premaz na staklu
bojeno u masi



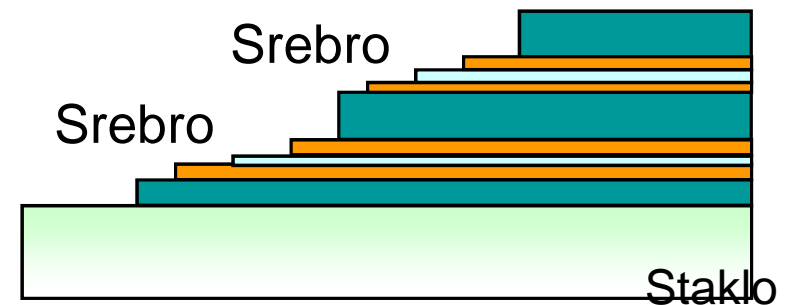
Magnetron-premaz na
ExtraClear™ float staklu

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Solar Control Glass

SUNGUARD® SUPERNEUTRAL

„Split-Silver“ / „Duplo-srebro“ premaz



- 2 x srebro = visoko selektivnost
- Skidanje premaza obavezno
- Posebne verzije za kaljenje (HT) sa zaštitnom folijom (TPF)
- Na ExtraClear float staklu

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Solar Control Glass

SUNGUARD® SUPERNEUTRAL

Propusnost Svjetlosti: **40 ... 70 %**

Refleksija Svjetlosti: **11 ... 16 %**

Totalna Transmitovana Energija (Solarni Faktor): **23 ... 41 %**

Ug-vrijednost: : **1,0 - 1,1 W/m²K*** (EN 673)

* Iajsna: 16 (15) mm punjeno Argonom

Tipovi na **ExtraClear™**

SN 70/41

SN 51/28

SN 70/37

SN 40/23

SN 62/34

SN 29/18

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SUNGUARD[®] EXTRA SELECTIVE

SNX 60/28

Ug-vrijednost: : **1.0 W/m²K*** (EN 673)



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Solar Control Glass



**GUARDIAN
SUNGUARD®**

ADVANCED ARCHITECTURAL GLASS

Reference



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Solar Control Glass – Projects

Yachting, Zagreb

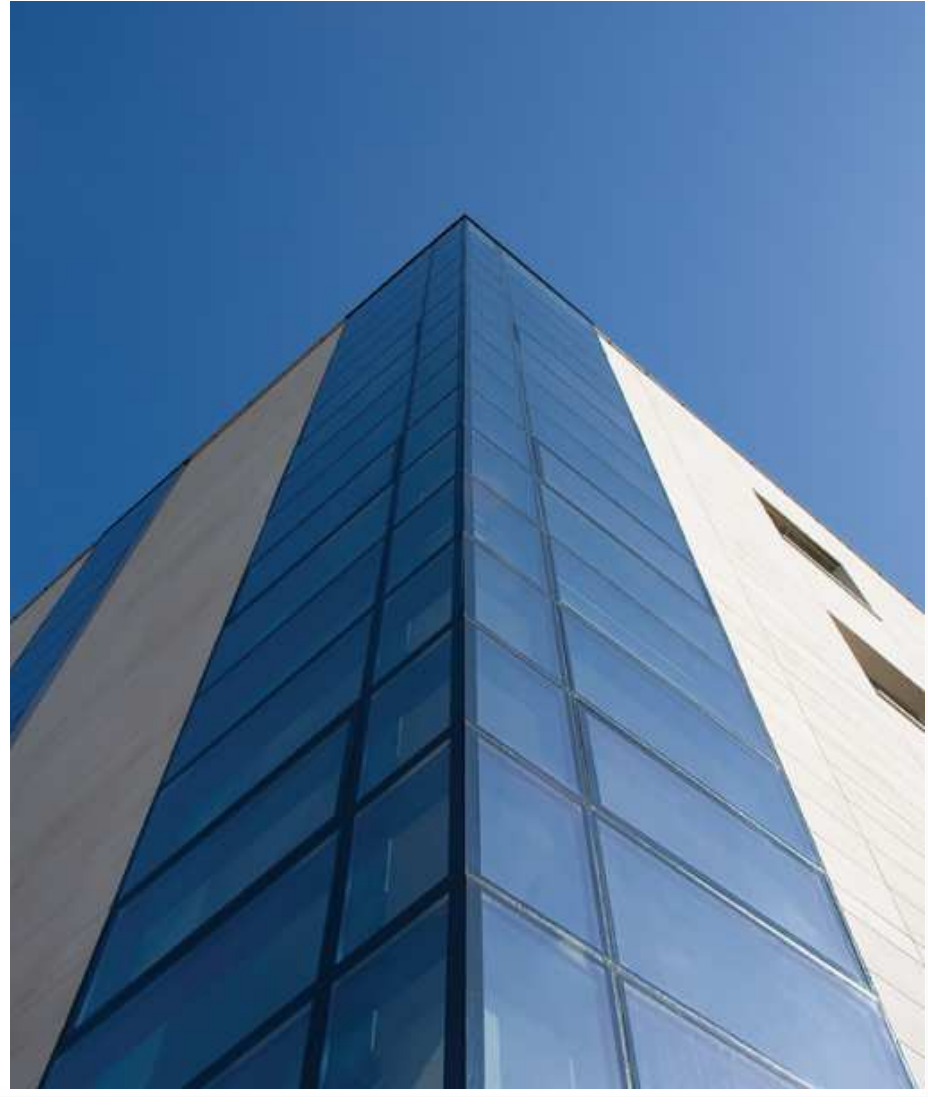
SUNGUARD® SOLAR LIGHT BLUE 52



Solar Control Glass – Projects

BH-Telekom / Pošta, Mostar, BiH

SUNGUARD® SN 62/34



Solar Control Glass – Projects

K&H Bank, Budapest

SUNGUARD® SN 62/34



Solar Control Glass – Projects

Hotel Ózon, Kékestető, Hungary

CLIMAGUARD® NEUTRAL 70

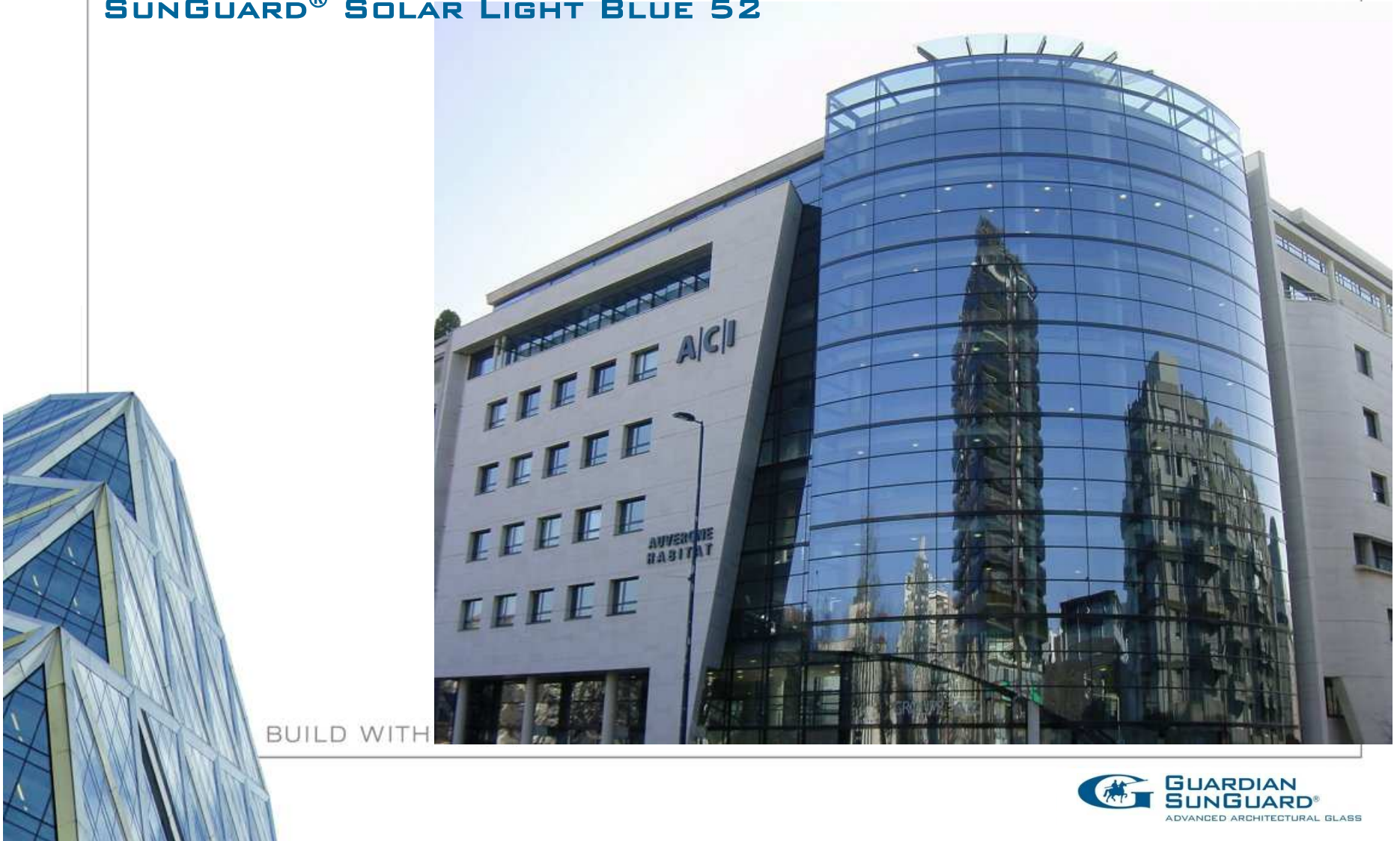


Solar Control Glass – Projects

Auvergne Habitat, Clermont Ferrand

Arch. Vigneron et Grispan

SUNGUARD® SOLAR LIGHT BLUE 52



Solar Control Glass – Projects

Munich Airport

Architekt: Helmut Jahn

SUNGUARD® SUPERNEUTRAL 63



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Solar Control Glass – Projects

Tati Center, Bucharest

SUNGUARD® HP ROYAL BLUE 41/29



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Solar Control Glass – Projects

SONY / Daimler Crysler, Berlin

Arch. Helmut Jahn / Prof. Kollhof

SUNGUARD[®] HS SUPERNEUTRAL 63 / CLIMAGUARD[®] N



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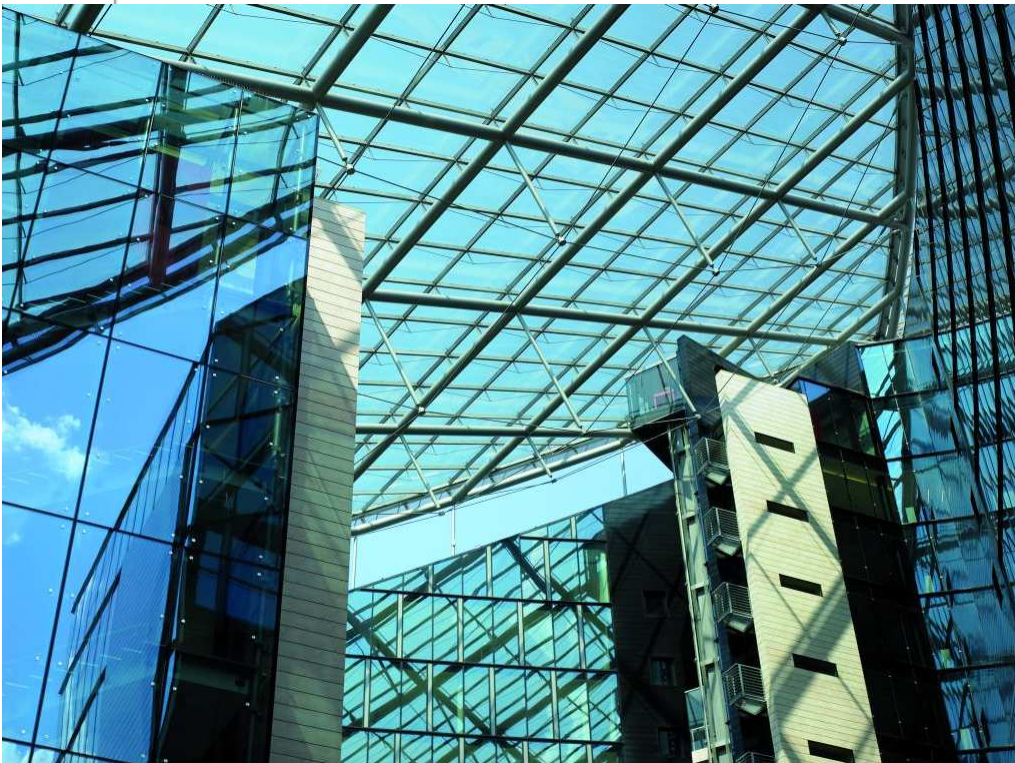


Solar Control Glass – Projects

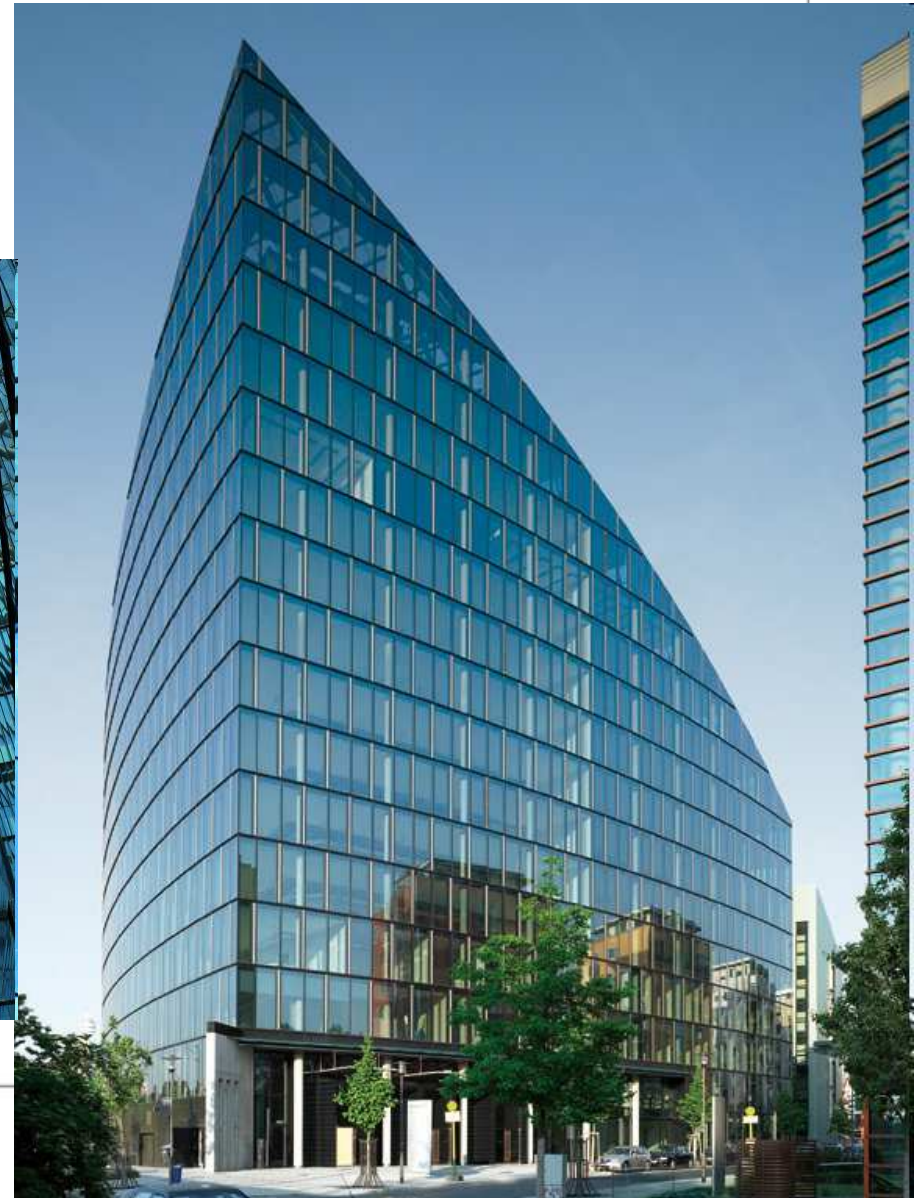
Main Triangle, Frankfurt

Arch.: 3H Architecten

SUNGUARD® SN 51/28



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Solar Control Glass – Projects

Eureko Insurance, Istanbul



Solar Control Glass – Projects

Istinye Park, Istanbul

SUNGUARD® HP NEUTRAL 60/40



BUILD WITH LIGHT™



Solar Control Glass – Projects

Ritz Carlton, Moscow

Arch. Meyerson Architects

SUNGUARD® HP LIGHT BLUE 62/52, NEUTRAL 52/41, NEUTRAL 41/33



BUILD



Solar Control Glass – Projects

Mercedes Plaza,

Moscow

Arch. Boris Levyant

SUNGUARD® HP

NEUTRAL 60/40



BUILD WITH LIGHT™



Solar Control Glass – Projects

AOL Time Warner, New York

Skidmore, Owings & Merrill LLP

SUNGUARD® SOLAR SILVER GREY 32

SUNGUARD® HP NEUTRAL 60/40



BUILD WITH LIGHT™



Solar Control Glass – Projects

Architect: W.S. Atkins **Burj Al Arab**

SUNGUARD® CR14 & CS 20

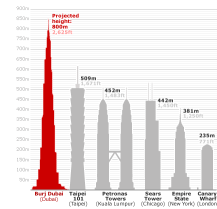


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