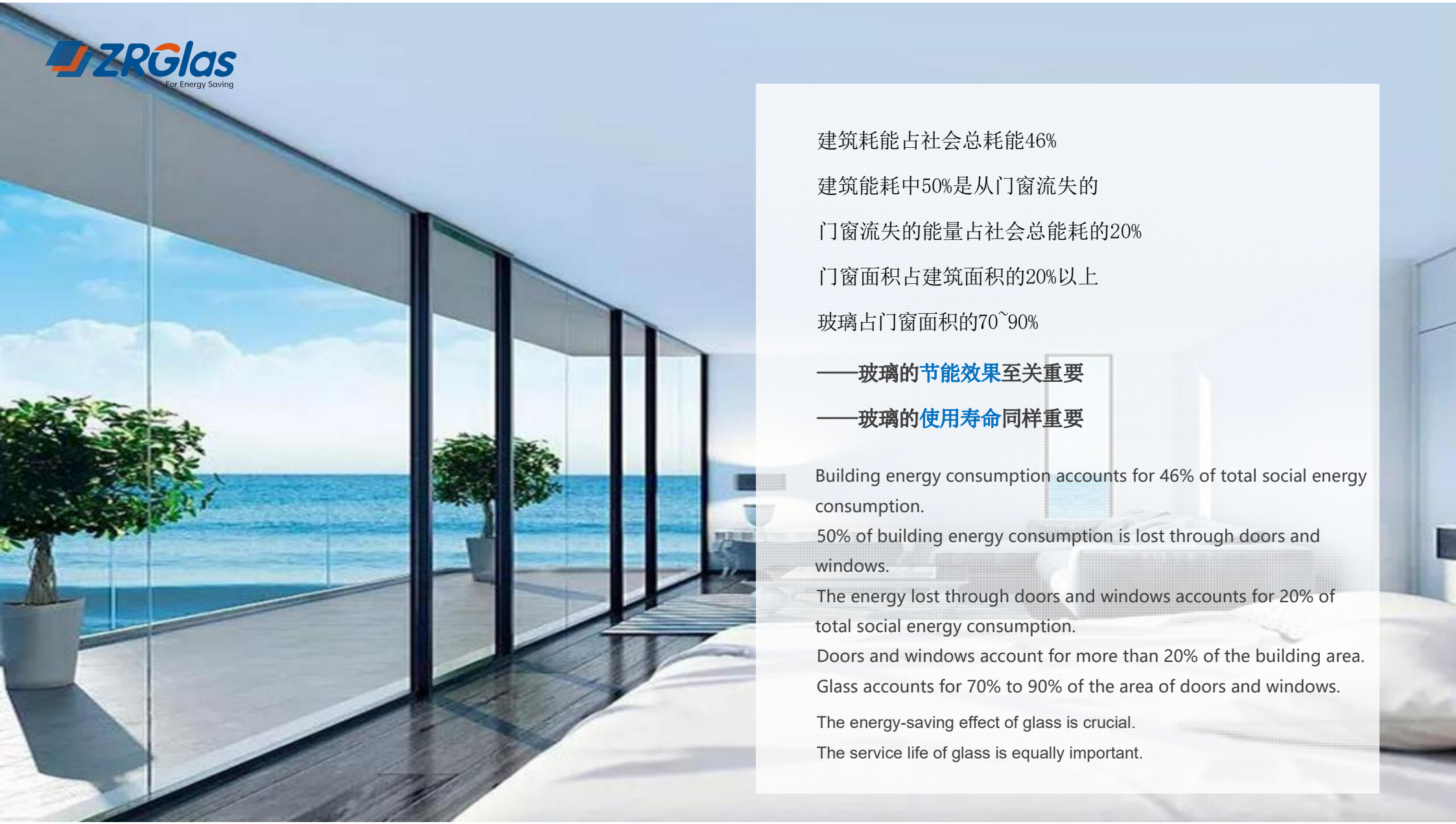
ZRGlas
For Energy Saving

4SG

IG Glass永久密封系统

IG Glass permanent
sealing system



建筑耗能占社会总耗能46%

建筑能耗中50%是从门窗流失的

门窗流失的能量占社会总能耗的20%

门窗面积占建筑面积的20%以上

玻璃占门窗面积的70~90%

——玻璃的节能效果至关重要

——玻璃的使用寿命同样重要

Building energy consumption accounts for 46% of total social energy consumption.

50% of building energy consumption is lost through doors and windows.

The energy lost through doors and windows accounts for 20% of total social energy consumption.

Doors and windows account for more than 20% of the building area.

Glass accounts for 70% to 90% of the area of doors and windows.

The energy-saving effect of glass is crucial.

The service life of glass is equally important.

目　录

CONTENT

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01

玻璃如何实现节能减耗

How to save energy and reduce consumption of glass

影响玻璃的两个节能参数指标

There are two energy-saving parameter indicators that affect glass

透过玻璃传递热能的计算公式：

Formula for calculating the heat transfer through glass.

$$Q=0.87Io \times Sc + U(T外-T内)$$

太阳能透过Solar transmittance，对流、 传导透过convection, and conduction transmittance.

参数说明Parameter:

Q —— 单位面积玻璃透过热能的功率，W/㎡.K；

Power per unit area of glass through heat energy

I_0 —— 太阳辐射强度w/㎡； Solar radiation intensity

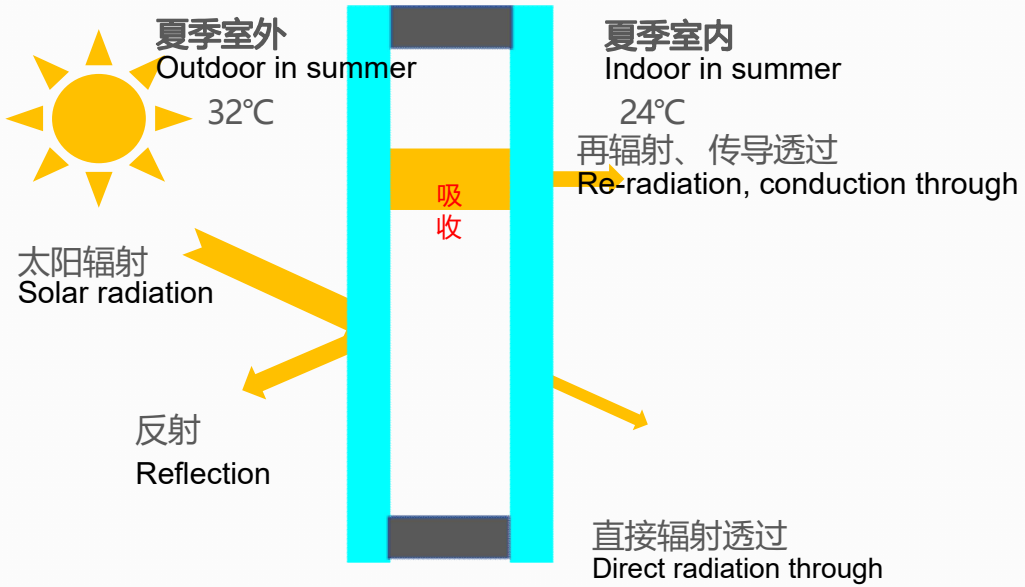
Sc —— 玻璃遮阳系数； **SC越低遮阳效果越好**；

Glass shading coefficient; The lower the SC, the better the shading effect

U —— 玻璃的传热系数W/㎡.K； **U值越低隔热能力越好**；

T外、 T内 —— 室外、 室内的环境温度℃。

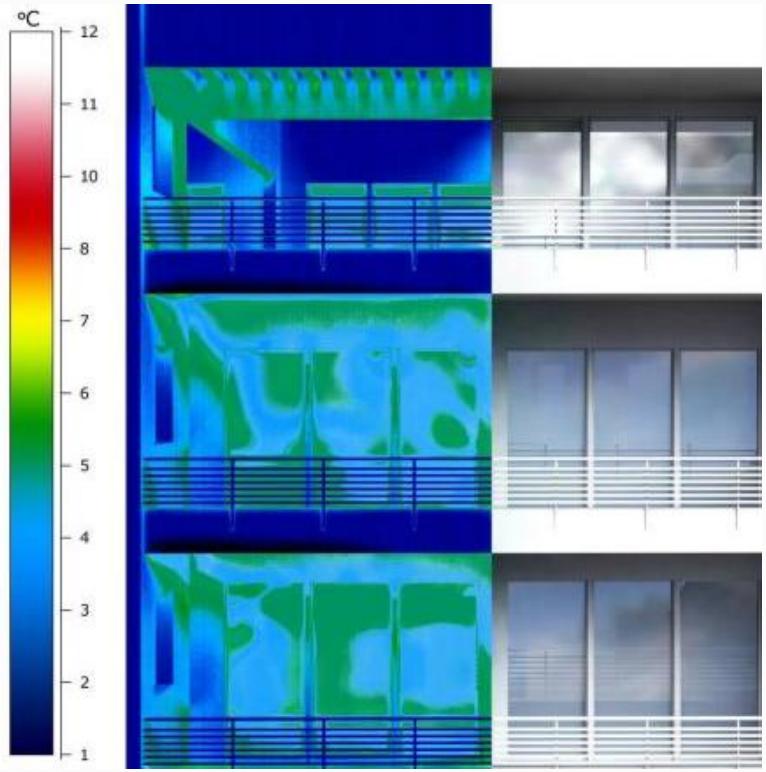
Glass heat transfer coefficient W/㎡.K; The lower the U value, the better the heat insulation capacity; T outside, T inside - outdoor and indoor ambient temperatures ℃.



影响中空玻璃U值最小化能量损失的因素

Factors affecting the minimization of energy loss in the U value of insulating glass

- 玻璃性能
  Glass performance
- 高质量而长效的气体密封
  High quality and long lasting gas seal
- 暖边系统
  warm edge system



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如何降低U值 — 玻璃性能
How to reduce U-value - glass profermace

Heat Mirror
美国热镜技术

隔热保温效果相当于0.9米-1.3米厚度的实体墙，太阳能总隔热率达到70%以上.
The heat insulation effect is equivalent to that of a solid wall with a thickness of 0.9-1.3 meters, and the total solar heat insulation rate reaches more than 70%.

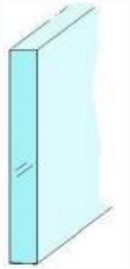
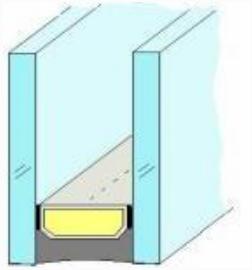
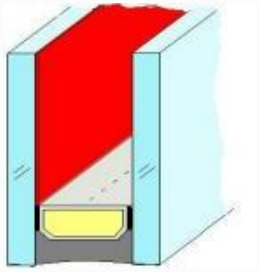
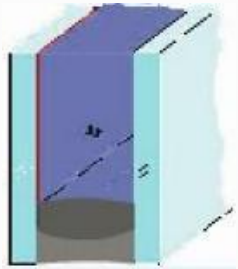
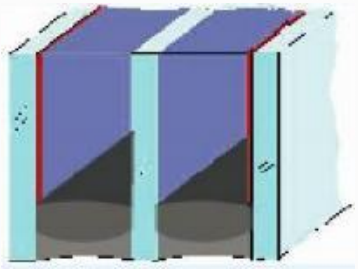
Suntuitive
美国智慧技术

Solarban
美国超级镀膜技术

如何降低U值 — 玻璃配置

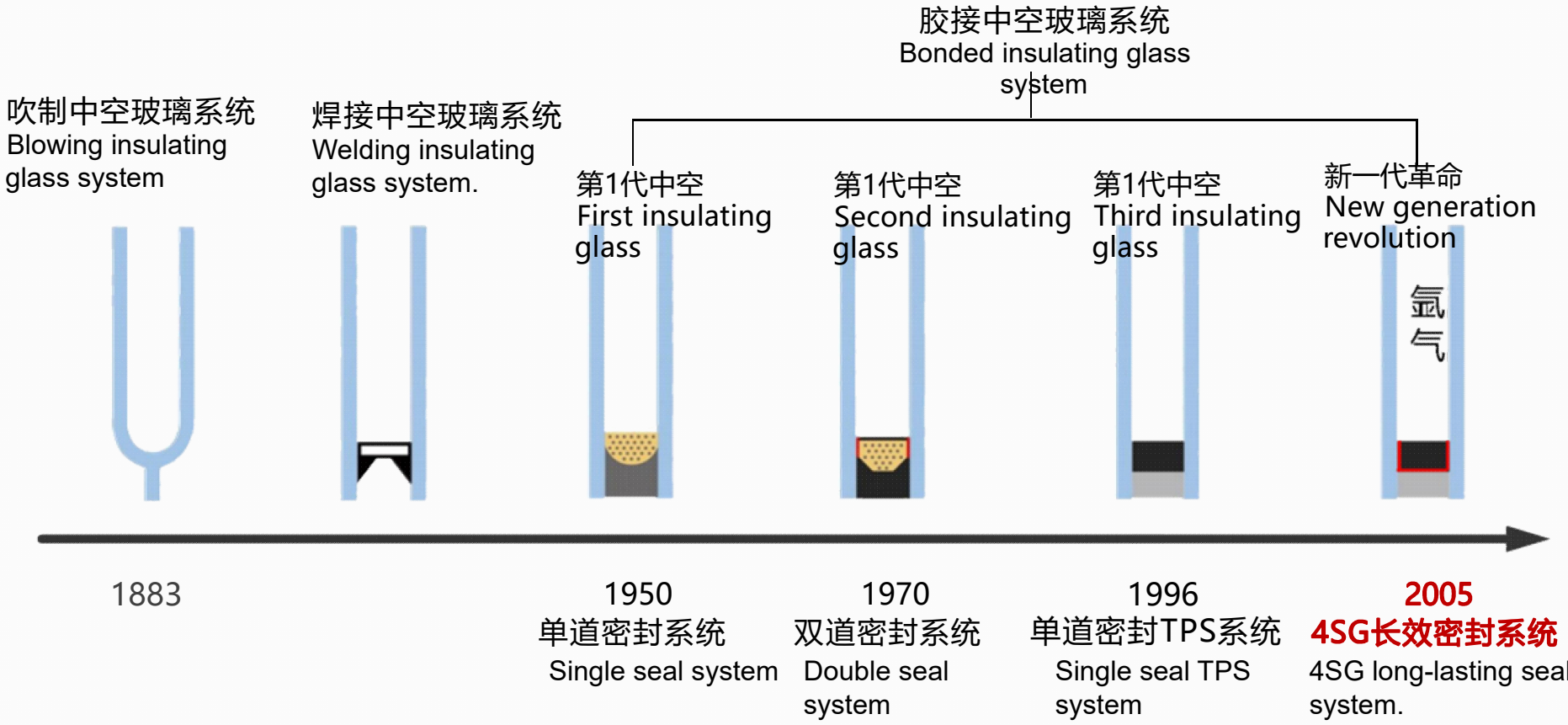
How to reduce U-value - glass configuration

4SG长效密封 保证玻璃性能
Long-term sealing ensures glass performance.

5.8 W/m²K	3.0 W/m²K	1.8 W/m²K	1.0 W/m²K	0.6 W/m²K
				
单层玻璃 Single glass	中空玻璃 Insulating glass	+ 镀膜 ε Reflctive glass (0,03)	+ 镀膜 ε Reflctive glass (0,03) + **4SG暖边 Warm edge** +90%氩气 Argon gas	三玻两腔中空玻璃 Three-glass, two-cavity insulating glass. (+ 2 x 镀膜 ε Reflctive glass 0,03, + **4SG暖边Warm edge** + 90 % 氩气Argon gas)

如何降低U值 — 中空玻璃系统演变

How to Reduce U Value - Evolution of Insulating Glass Systems.



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02

玻璃如何保证长效密封

How to ensure long - term sealing of glass

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FSG全球测试认证报告
FSG Global test certification report

产品再好
过期不保
长久有效才是制胜法宝

4SG密封系统

为客户提供至少

25年的性能保证！

No matter how good the product is,
it is not guaranteed after expiration.
Long-term effectiveness is the key to success.
4SG sealing system
Provides customers with at least
a 25-year performance guarantee!

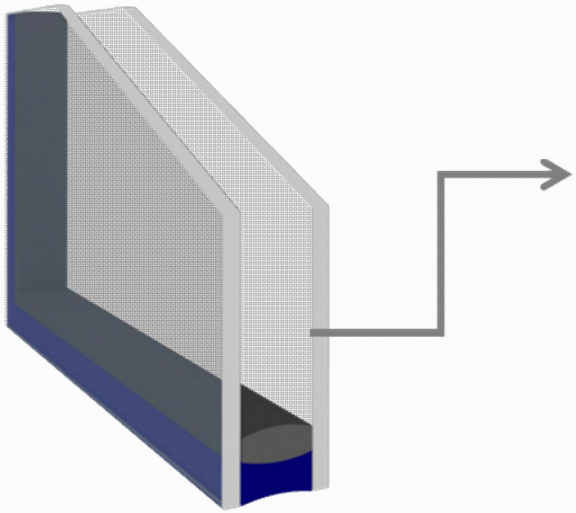
影响中空玻璃寿命的因素

Factors affecting the service life of insulating glass.

GB50096-2011《住宅设计规范》标准中的要求， 建筑物的寿命应不少于50年。门窗幕墙作为建筑的重要组成部分，其使用的中空玻璃的使用寿命已经引起业内人士的关注，在GB/T11944-2012《中空玻璃》标准的附录A“中空玻璃失效原因及使用寿命”中提到，**中空玻璃的预期使用寿命至少应为15年。**中空玻璃的使用寿命与边部材料 （**如间隔条、干燥剂、密封胶**）的质量和中空玻璃的制作工艺有直接关系。

According to the requirements of the GB50096-2011 "Design Code for Residential Buildings" standard, the service life of buildings should not be less than 50 years. As an important part of buildings, the service life of insulating glass used in doors, windows, and curtain walls has attracted the attention of professionals in the industry. In the appendix A "Causes of Failure and Service Life of Insulating Glass" of the GB/T11944-2012 "Insulating Glass" standard, it is mentioned that the expected service life of insulating glass should be at least 15 years. The service life of insulating glass is directly related to the quality of edge materials (such as spacers, desiccants, sealants) and the manufacturing process of insulating glass.

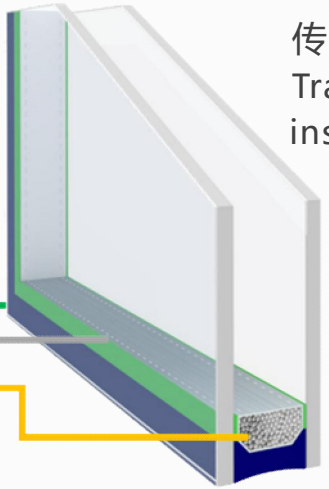
4SG中空玻璃
4SG insulating glass



丁基胶
glue

金属隔条
spacer

分子筛
deccicant



传统中空玻璃
Traditional
insulating glass

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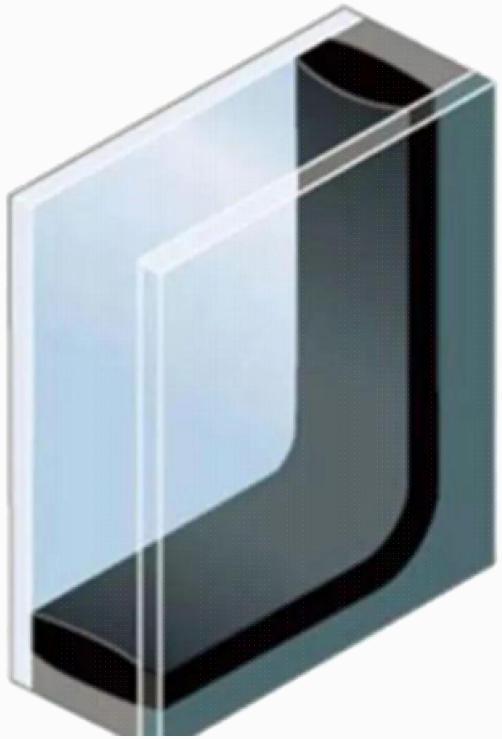
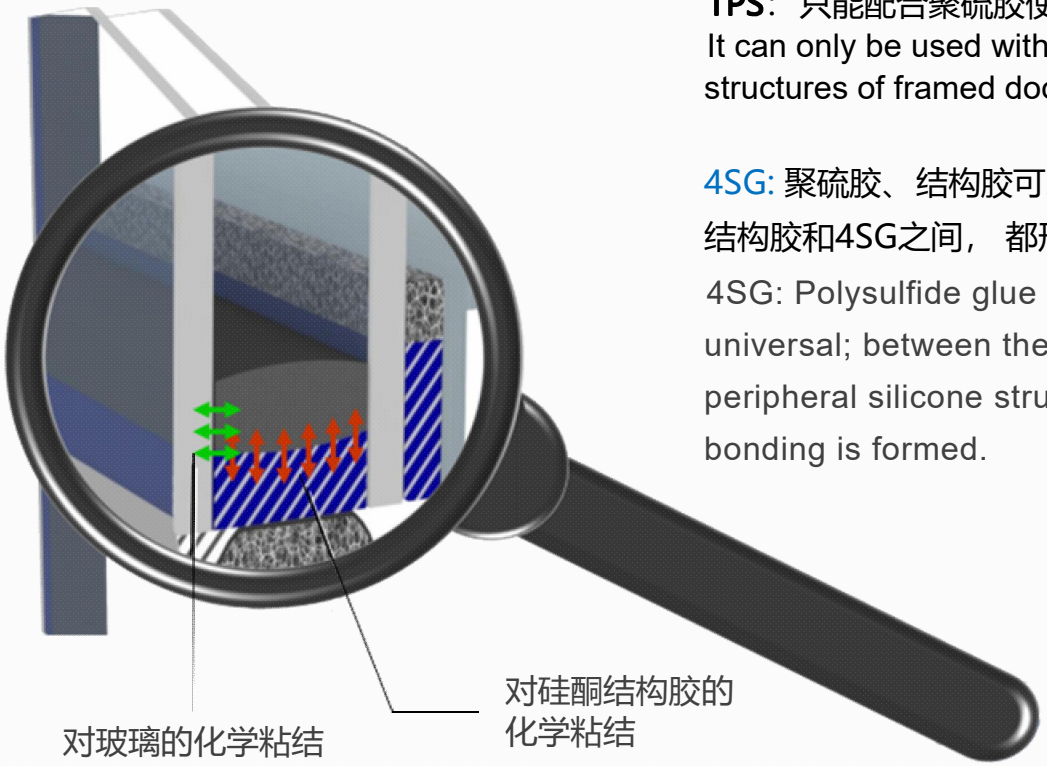
4SG长效密封系统

4SG long-lasting seal system

属性	FSG
基材 Base material	反应型聚异丁烯 Polyisobutylene
颜色 Color	黑色 Black
环境适用温度 Temperature	-70℃ - +90℃
气体穿透率 Gas penetration	< 0.002g/㎡.d
水汽通过率 Moisture permeability.	< 0.1g/㎡.d
粘接方式 Bonding mode	化学粘接 Chemical bonding
可配合使用的二道胶 Second glue	聚硫胶+硅酮结构胶 Polysulfide adhesive + silicone structural adhesive
应用领域 Application	门窗、 幕墙及其他相关领域 Doors, Windows, curtain walls and other related fields



4SG长效密封系统
4SG long-lasting seal system



4SG结构 structure

TPS：只能配合聚硫胶使用，适合于明框门窗类玻璃结构或幕墙。
It can only be used with polysulfide glue and is suitable for glass structures of framed doors and windows or curtain walls.

4SG: 聚硫胶、结构胶可以通用；在玻璃和4SG之间、外围硅酮结构胶和4SG之间， 都形成了化学性的粘接。
4SG: Polysulfide glue and structural glue can be universal; between the glass and 4SG, and between the peripheral silicone structural glue and 4SG, chemical bonding is formed.

- 更佳优良的玻璃粘接性
- 独一无二的硅酮粘接能力
- 更高的内聚力， 中空系统可以长期工作于-40~90摄氏度的环境中
- Better glass adhesion
- Unique silicone bonding ability
- Higher cohesion, the insulating glass system can work in an environment of -40~90 degrees Celsius for a long time.

超强的气体密封性能

Superior gas sealing performance

TÜVRheinland

CERTIFICATE

We hereby certify that

KÖMMERLING

KÖMMERLING CHEMISCHE FABRIK GMBH

Zweibrücker Straße 200
D-66954 Pirmasens
Germany

has demonstrated that the following product is able to meet the requirements in the European Standards EN 1279-2 and EN 1279-3:

Triple glazed insulating glass (4-12-4-12-4) with KÖMMERLING KÖDISPACE warm-edge spacer

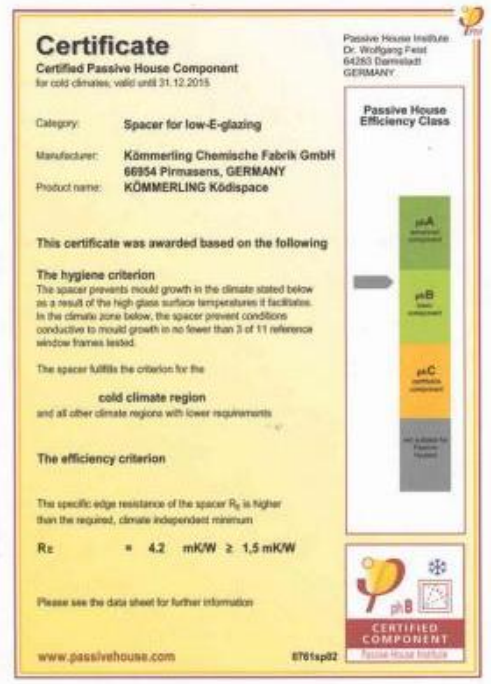
by TÜV Rheinland Nederland reports
9905R-10.28201 EN 1279-2
9906R-10.28201 EN 1279-3

TÜVRheinland®
Precisely Right.

4SG密封系统是全世界市场上唯一获得

欧洲惰性气体泄漏率EN1279-3认证的三玻两腔中空系统

The 4SG sealing system is the only one available on the world market，European noble gas leakage rate EN1279-3 certified three glass two chamber hollow system



Certificate

Certified Passive House Component

for cold climates, valid until 31.12.2015

Passive House Institute
Dr. Wolfgang Feist
64283 Darmstadt
GERMANY

Category: Spacer for low-E-glazing

Manufacturer: Kömmerling Chemische Fabrik GmbH
66954 Pirmasens, GERMANY

Product name: KÖMMERLING Ködispace

Passive House Efficiency Class

μA
μB
μC

This certificate was awarded based on the following

The hygiene criterion

The spacer prevents mould growth in the climate stated below as a result of the high glass surface temperatures it facilitates. In the climate zone below, the spacer prevent conditions conductive to mould growth in no fewer than 3 of 11 reference window frames tested.

The spacer fulfills the criterion for the

cold climate region

and all other climate regions with lower requirements

The efficiency criterion

The specific edge resistance of the spacer R_E is higher than the required, climate independent minimum

R_E = 4.2 mK/W ≥ 1,5 mK/W

Please see the data sheet for further information

φB

CERTIFIED COMPONENT

Passive House Institute

www.passivehouse.com

8761sp02

PHI （德国被动房研究所） 认证

(German Passive House Institute) certification

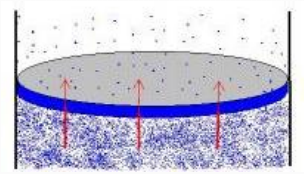
超强的水汽密封性能
Super moisture-proof sealing performance

分子筛的吸水是可逆，4SG是不可逆的

The water absorption of molecular sieve is reversible, while 4SG is irreversible.

MVTR (水汽透过率)

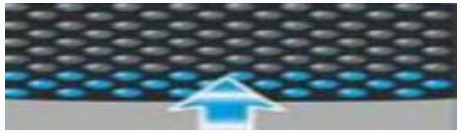
Water vapor transmittance



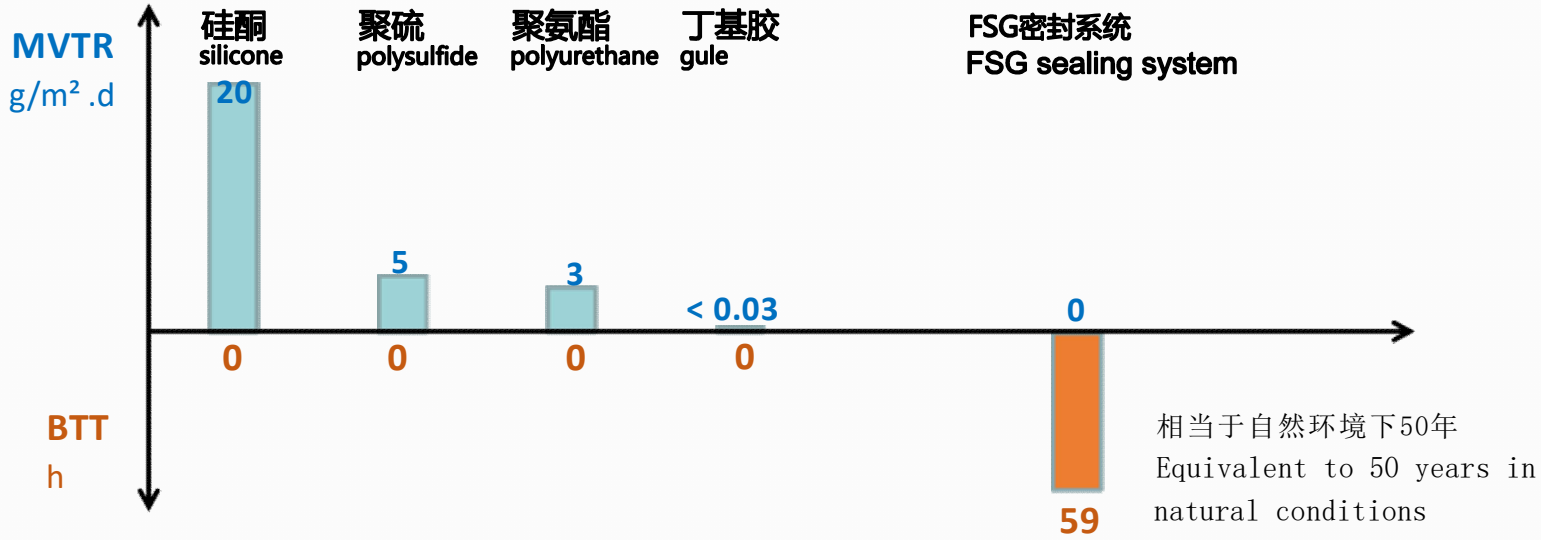
EN 1279 Part 4, 23°C/100%r.h., 2mm 胶膜 film

BTT (水分子穿透时间)

Water molecular penetration time



85°C/100%r.h., 1mm 胶膜 film



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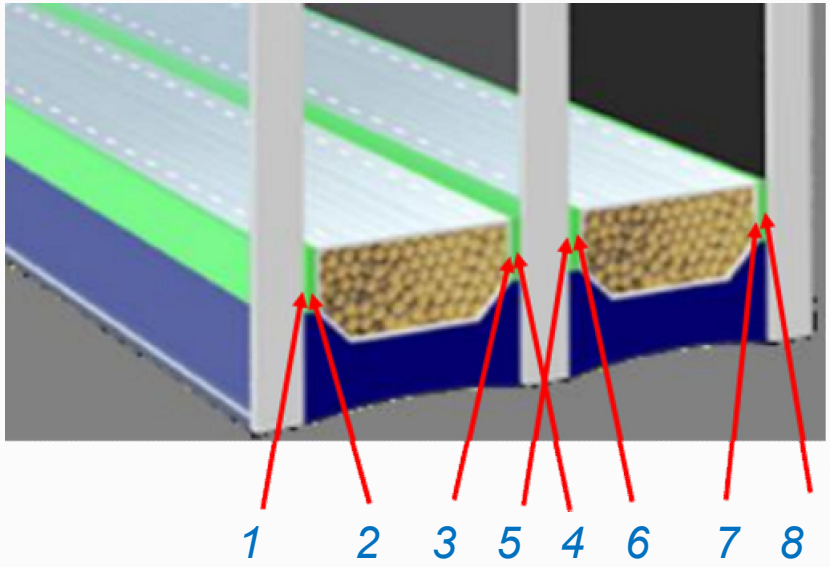
密封面减少，泄露风险降低

Reduced sealing surface, reduced leakage risk

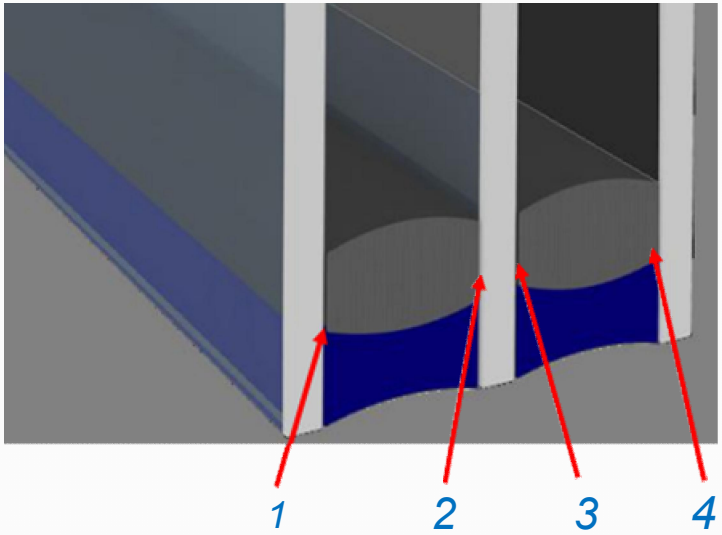
8个密封接触面,泄露点更多

With 8 sealing contact surfaces, there are more leakage points



4个密封接触面，泄露风险降低50%

With 4 sealing contact surfaces, the leakage risk is reduced by 50%.

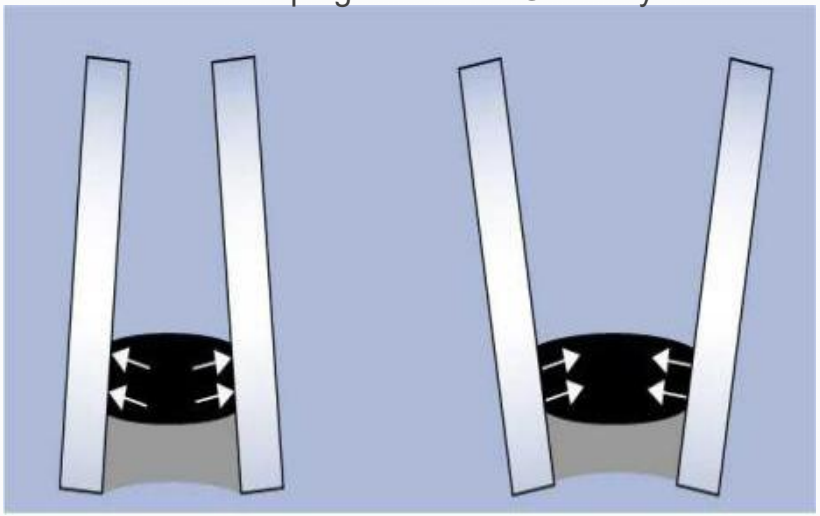


弹性的边缘密封、化学键粘接 （可长期在-40-90℃环境中使用）

Flexible edge sealing, chemical bonding
(can be used in the environment of -40-90° C for a long time)

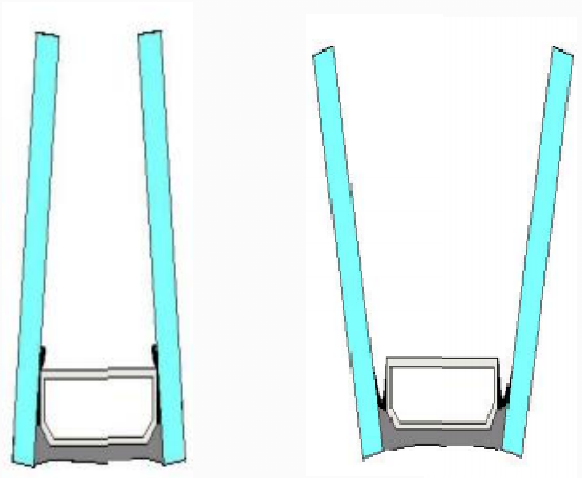
玻璃泵吸作用下对密封系统长期撕扯或挤压而造成间隔条蠕变问题。
Under the action of glass pump, the sealing system is torn or squeezed for a long time, which causes the spacing strip creep.

泵吸动作 – 4SG没问题
Pumping action - 4SG is okay



弹性体在正负、压条件下，仍能保持良好的边缘密封性
Elastomer can still maintain good edge sealing under positive and negative pressure conditions

泵吸动作—槽铝式密封失效
Pumping action - slot aluminum seal failure



过度压合和拉伸发生密封失效
Sealing failure occurs due to excessive compression and stretching.

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03

4SG系统的优越性

Advantages of 4SG system

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4SG长效密封系统的优势
Benefits of 4SG long-term sealing system

30年长效密封
通过5倍国标测试
30-year long-lasting seal
Passed 5 times international testing

更高的能源效率
化学性粘接 材料一体化
High energy efficiency
Chemical bonding, material integration

暖边效应
降低边缘结露风险
Warm edge effect
/Lower the risk of edge condensation

持续稳定U值贡献
中空玻璃性能持久在线
Continuous and stable U-value contribution
Long-lasting performance of insulating glass

主/被动全频隔音降噪
惰体持久性 不等腔体
Full-frequency sound insulation and noise reduction
Inertia gas persistence

结构多样性
多腔体、平面异形
Diverse structures
Multi-chamber、irregular glass

极端环境适应
-40℃-+90℃的稳定性
Extreme environmental adaptability
-40℃+90℃ stable

极致美观
弹性边缘无缝密封
Ultimate beauty
Elastic edge seamless seal

优势一： 25年长效密封， 性能长效持久

Advantage 1: 25-year long-lasting seal, long-lasting performance

GB测试实验

GB test experiment

	FSG
氩气含量%，初始值 Argon content, initial value	90%
氩气含量%，第1次循环后 Argon content, after the first cycle	89%
氩气含量%，第2次循环后 Argon content, after the 2nd cycle	88%
氩气含量%，第3次循环后 Argon content, after the 3rd cycle	87%
氩气含量%，第4次循环后 Argon content, after the forth cycle	87%
氩气含量%，第5次循环后 Argon content, after the fifth cycle	86%

按照GB11944-2012标准五个循环测试的结果

According to the results of the five-cycle test of the GB11944-2012 standard

4SG长效密封系统通过五个循环测试后

After 4SG long-lasting seal system passed five cycles of testing

■气体泄漏总量为4%，每个循环相当于10年

Gas leakage is 4%, each cycle is equivalent to 10 years

5个循环相当于自然条件下50年，气体泄漏率为：0.08%/年

Five cycles are equivalent to 50 years under natural conditions, and the gas leakage rate is: 0.08%/year

■露点仍然低于 -60°C

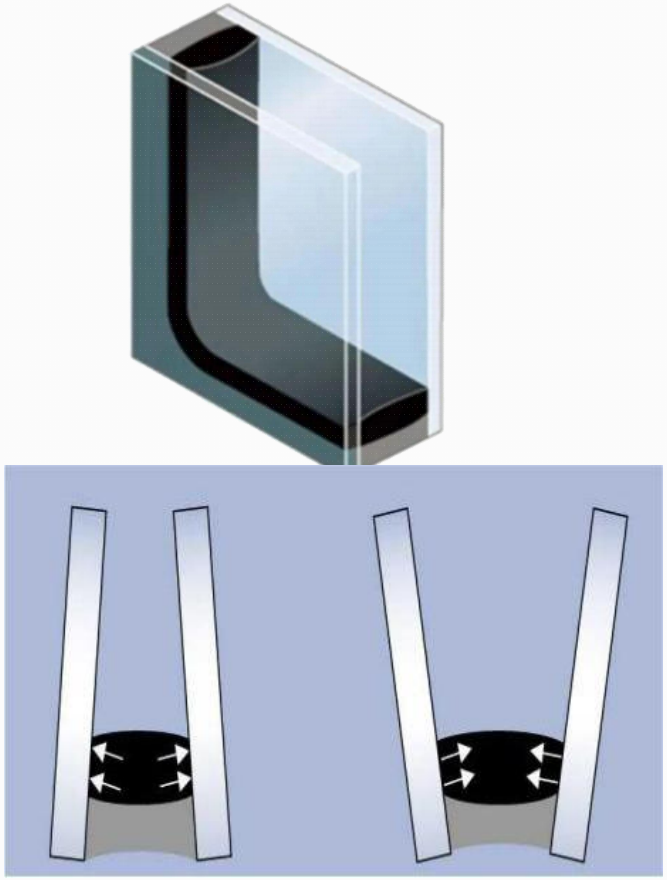
The dew point is still below -60°C

■国标要求小于1%/年， 15年以后中空性能衰减并失效

National standard requires less than 1%/year, and the insulating glass performance decays and fails after 15 years.

优势二： 更高的能源效率,降低能源成本

Advantage 2: Higher energy efficiency, reducing energy costs



化学性粘接 材料一体化

Chemical bonding, material integration

■4SG替代第一道密封丁基胶、 预成型隔条和分子筛

4SG replaces the first seal butyl rubber, prefabricated spacers, and molecular sieves

■弹性边缘密封，有效消除由温度、气压、风压、装配压力 导致的泵吸现象产生的影响

Elastic edge sealing effectively eliminates the impact of pumping phenomenon caused by temperature, air pressure, wind pressure, and assembly pressure

■全自动化生产系统， 确保质量的稳定性

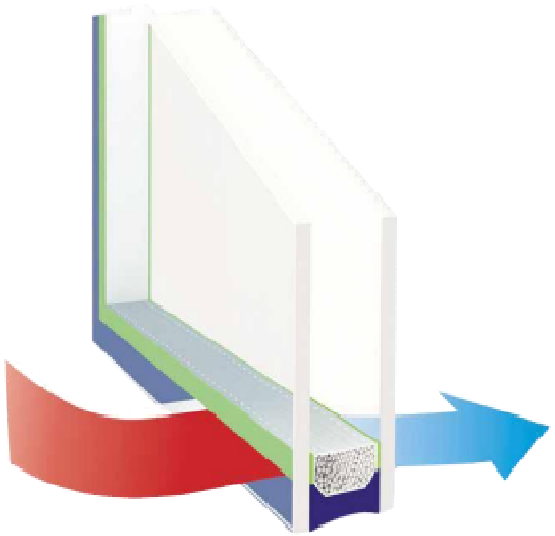
Fully automated production system to ensure quality stability

优势三： 暖边效应， 降低边缘结露风险

Advantage 3: Warm edge effect, reducing the risk of edge condensation

传统中空玻璃系统

Traditional insulating glass system

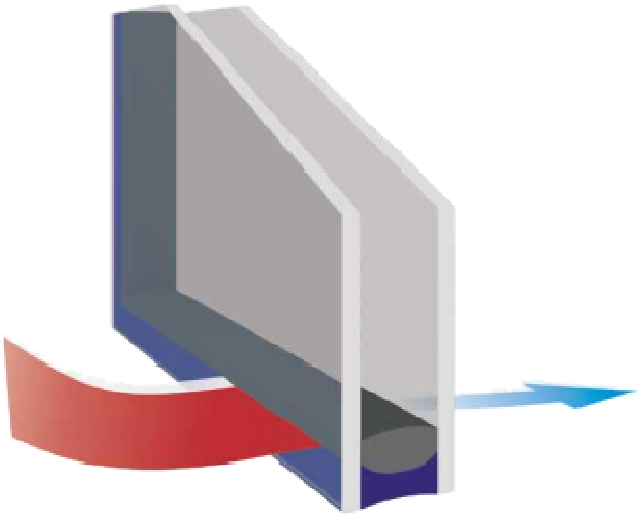


金属型材传导热量和/或寒冷，
导致不理想的隔热效果

Metal profiles conduct heat and/or cold,resulting in unsatisfactory insulation effect

4SG中空玻璃系统

Traditional insulating glass system

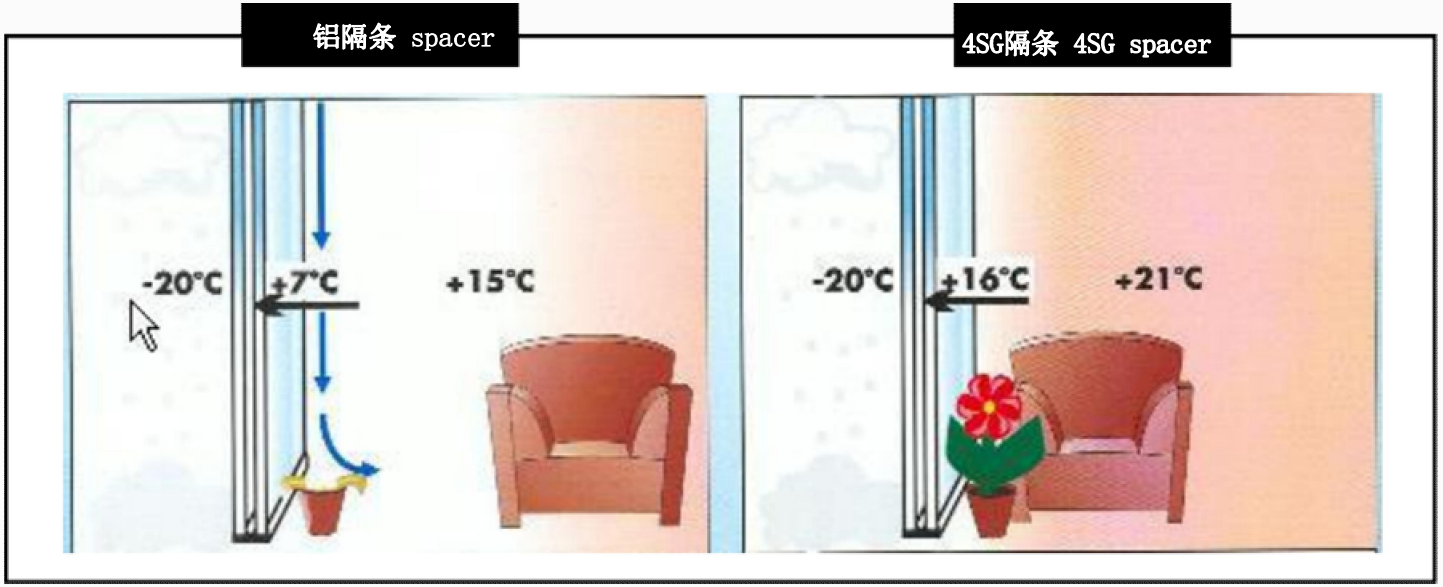


4SG作为暖边系统提供最佳的隔热效果，
从而降低采暖成本

4SG provides the best insulation effect as a warm edge system, Thus reducing heating costs.

优势三： 暖边效应， 降低边缘结露风险

Advantage 3: Warm edge effect, reducing the risk of edge condensation



铝条窗在冬天室内面附近的空气温度远低于室温，4SG较铝条窗热的阻隔性更好，可以显著提高室内靠窗处的空气温度、降低室内温差，并具有稳定室内气候、降低空气的对流、更加舒适的室内环境、降低玻璃边缘 结露的产生、抑制霉菌的产生、降低对窗框的维护费用、较低的模具应力、减少房屋热散失、降低能源消耗 的优势。

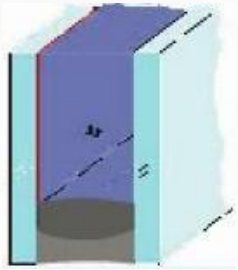
In winter, the air temperature near the indoor surface of aluminum profile windows is much lower than room temperature. 4SG has better heat insulation than aluminum profile windows, which can significantly increase the air temperature near the indoor windows, reduce the indoor temperature difference, and has the advantages of stabilizing the indoor climate, reducing air convection, a more comfortable indoor environment, reducing the generation of condensation on the glass edge, inhibiting the generation of mold, reducing the maintenance cost of window frames, lower mold stress, reducing heat loss from houses, and reducing energy consumption.

优势四： 持续稳定U值贡献

Advantage 4: Continuous and stable U-value contribution

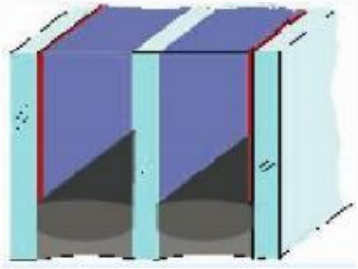
4SG长效密封 保证玻璃性能
4SG long-lasting seal ensures the performance of glass

1.0 W/m²K



+ 镀膜 reflective (0,03) ε + **4SG暖边 warm edge**+90%氩气argon

0.6 W/m²K



三玻两腔中空玻璃
Three-glass-two-cavity insulating glass
(+ 2 x 镀膜reflective ε0,03, + **4SG暖边 warm edge**+ 90 % 氩气argon)

优势五： 主动、 被动隔音降噪

Advantage 5: Active and passive sound insulation and noise reduction

被动降噪：

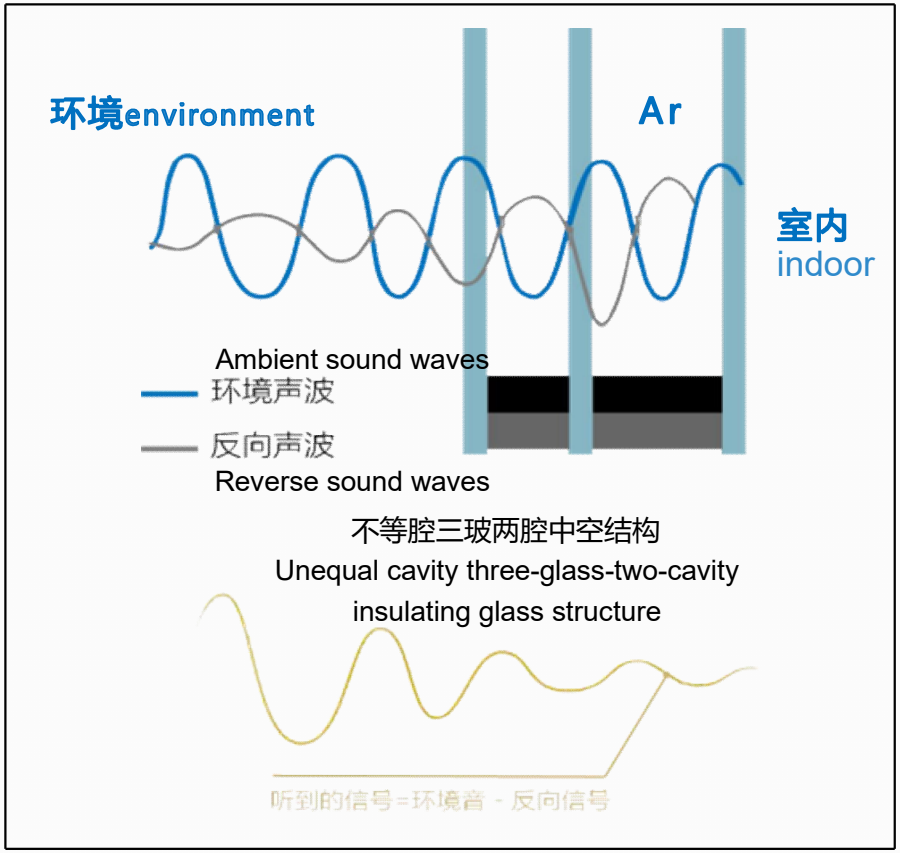
长久保存的惰性气体氩气吸声能力比空气强，
与普通中空玻璃一样具有减弱噪音能力

Passive noise reduction: The long-lasting inert gas argon has a stronger sound absorption capacity than air. It has the ability to reduce noise as ordinary insulating glass.

主动降噪：

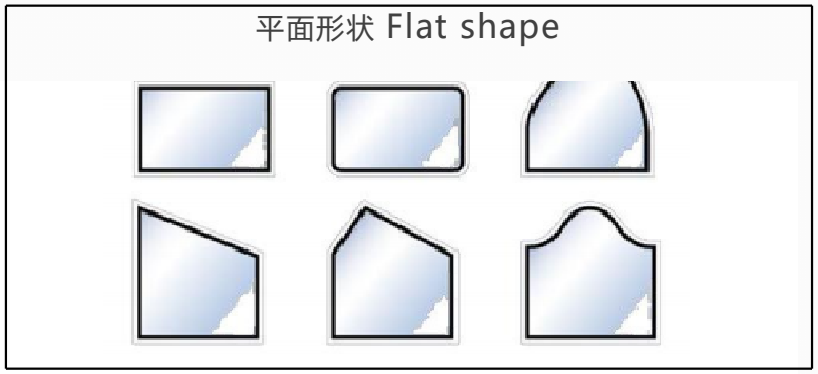
噪声在穿过玻璃时一部分会透过玻璃，一部分会被玻璃表面反射，不等腔体中空玻璃会增强这一反射 抵消外界噪音，达到降噪能力。不等腔体中空玻璃 成熟运用得益于4SG的技术加持。

Active noise reduction: When noise passes through the glass, part of it will penetrate the glass, and part of it will be reflected by the glass surface. The unequal cavity insulating glass will enhance this reflection to offset external noise and achieve noise reduction ability. The mature application of unequal cavity insulating glass benefits from the support of 4SG technology.

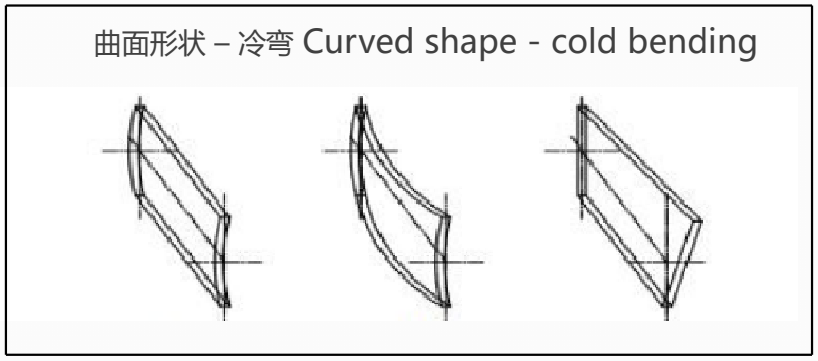


优势六： 产品结构多样性—异型、 冷弯工艺

Advantage 6: Diversity of product structure - special-shaped, cold bending process



艺术博物馆, 芬兰
Art Museum, Finland



Chadstone Stage 40,
墨尔本, 澳大利亚
Melbourne, Australia

优势六： 产品结构多样性-中空玻璃厚度的最终控制

Advantage 6: Diversity of product structure - final control of the thickness of insulating glass

中空玻璃的厚度公差过大严重影响门窗的装配质量！

目标：生产厚度28.00 mm的中空玻璃：

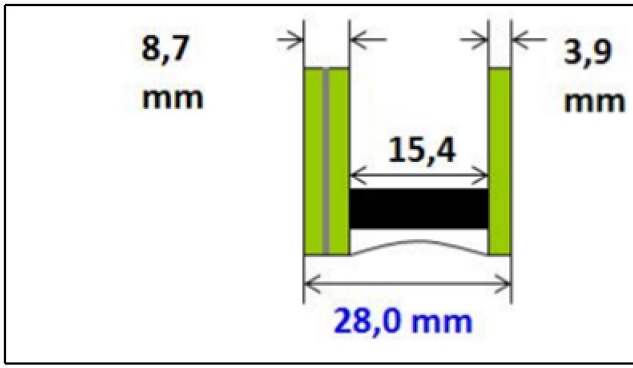
- 玻璃 1：浮法 4 mm.（实际 3.9 mm）
- 玻璃 2：夹层 8 mm（实际 8.7 mm 或 更厚）
- 两片玻璃间隔约 16 mm

The large thickness tolerance of insulating glass seriously affects the assembly quality of doors and windows!

Goal: Produce insulating glass with a thickness of 28.00 mm:

- Glass 1: Float glass 4 mm. (Actual 3.9 mm)
- Glass 2: Laminated 8 mm (actual 8.7 mm or thicker)
- The gap between the two pieces of glass is about 16 mm

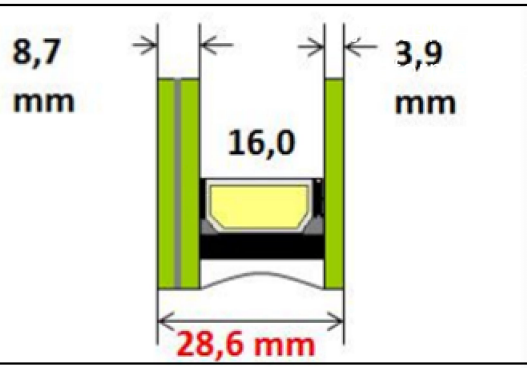
4SG



由于4SG系统可以支持从6mm到20mm的无级宽度调整，所以该系统支持中空玻璃最终厚度的自动化调整。

Because the 4SG system can support stepless width adjustment from 6mm to 20mm,this system supports the automated adjustment of the final thickness of insulating glass.

预成型隔条Preformed spacer



预成型隔条除了无法调节玻璃公差所带来的厚度偏离 外， 其合片参数对其厚度偏差也影响较大， 对于加工 尺寸变化加大的生产， 这种情况很难避免。

Prefabricated spacers, in addition to the thickness deviation caused by the inability to adjust the glass tolerance, also have a greater impact on their thickness deviation. For production with increased processing dimensions, this situation is difficult to avoid.

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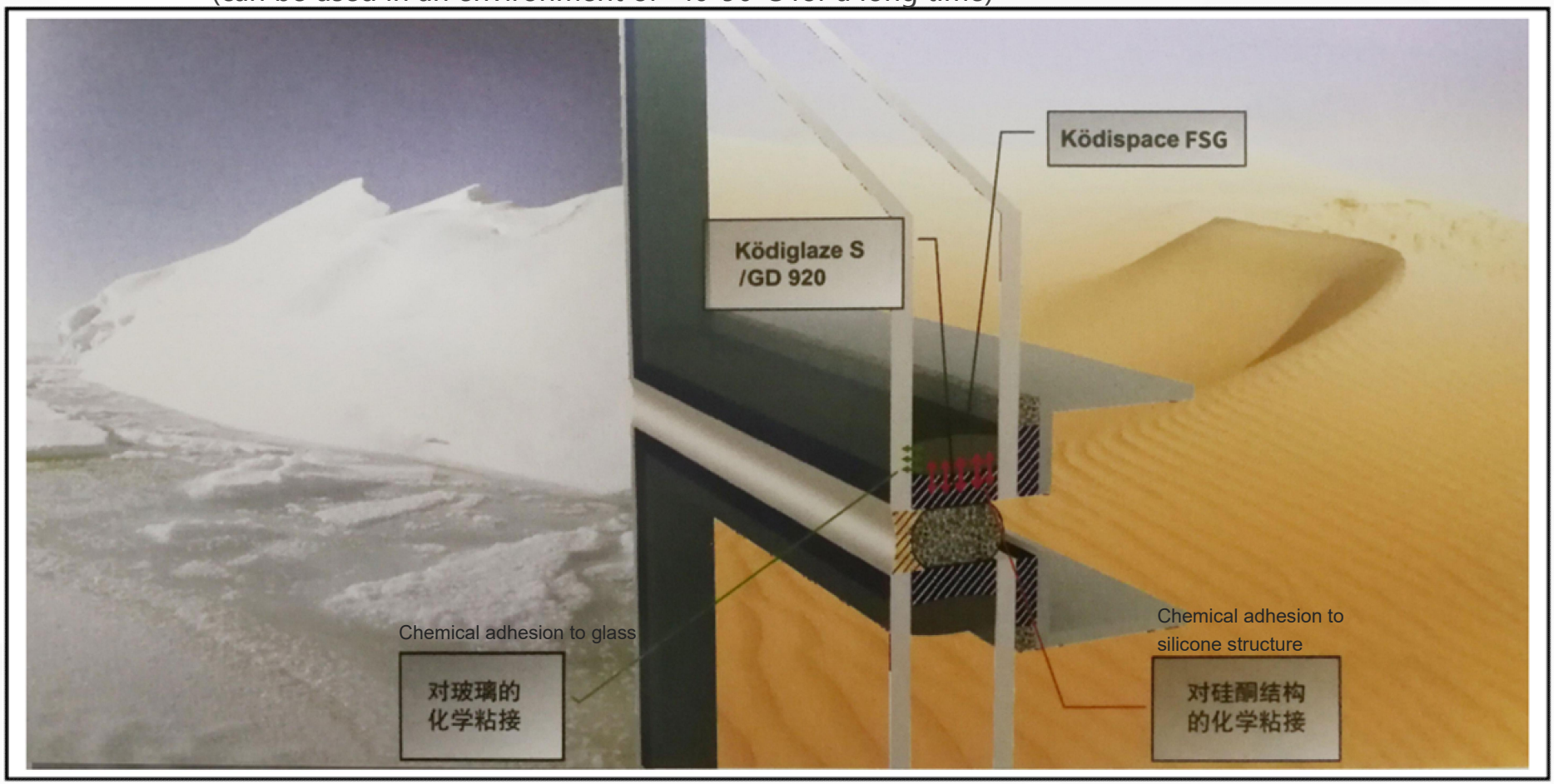
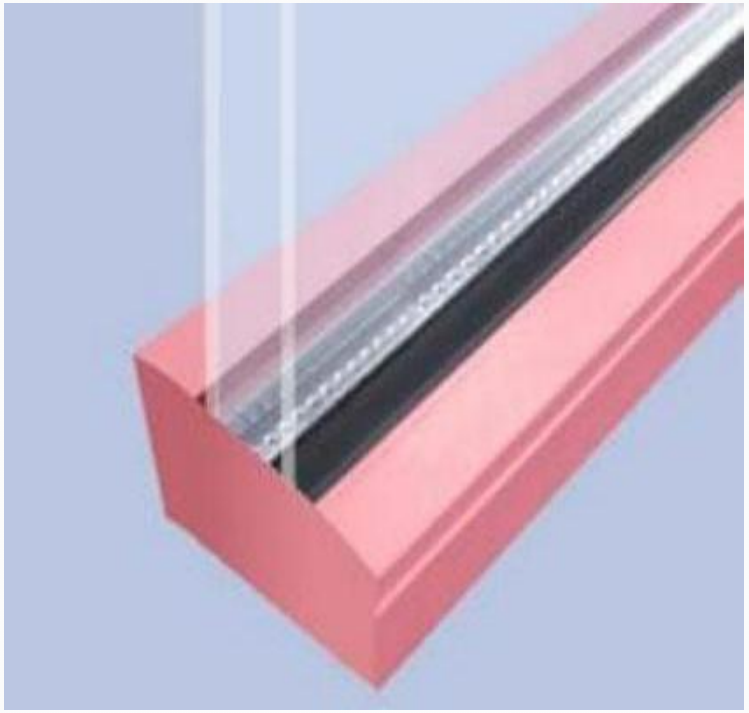
优势七：极端环境适应（可长期在-40-90℃环境中使用）

Advantage 7: Adaptation to extreme environments
(can be used in an environment of -40-90°C for a long time)



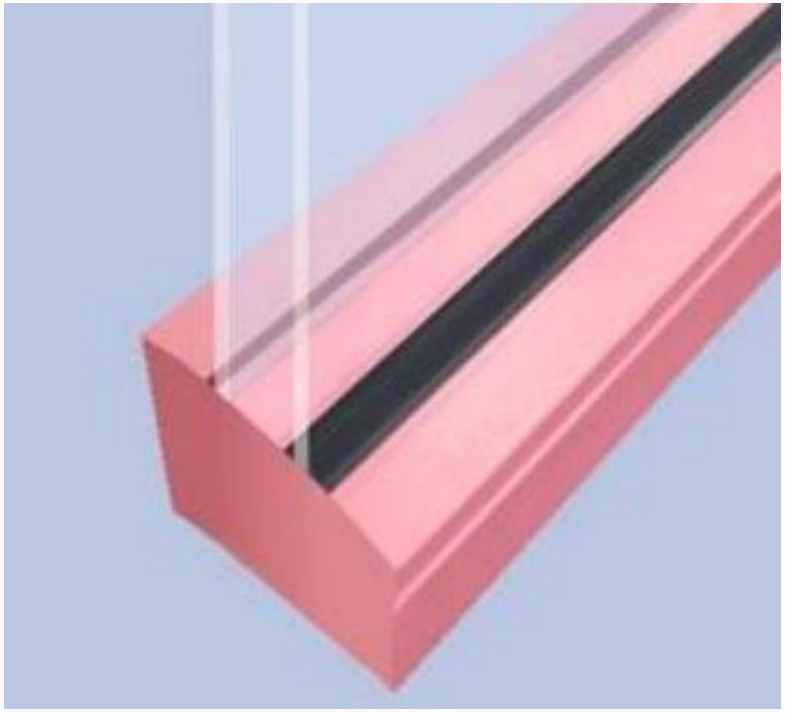
优势八：极致美观-更好的视觉感官统一

Ultimate beauty - better visual sensory unity



传统金属隔条

Traditional metal spacers



4SG系统

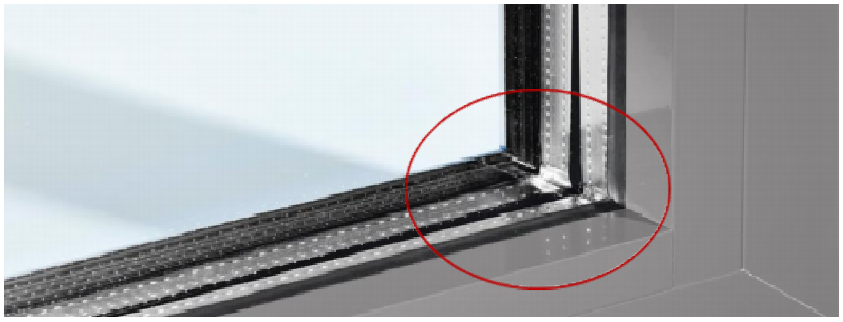
4SG system

优势八：极致美观-隔条叠差的精确控制

Advantage 8: Ultimate beauty -precise control of spacer overlap

传统隔条系统的三玻两腔中空玻璃

The three-glass-two-cavity insulating glass of the traditional spacer system



手工定位隔条很难保证精确定位，偏差造成室的低质量外观

Manual positioning of spacers is difficult to ensure precise positioning, and deviations result in a low-quality appearance of the room

4SG系统的三玻两腔中空玻璃

Three-glass-two-cavity insulating glass of the 4SG system

完全自动化生产应用可以保证隔条完美的同步定位，外观无缺陷

Full automation of production applications can ensure perfect synchronous positioning of spacers, with no defects in appearance

优势八： 极致美观-不存在内溢问题

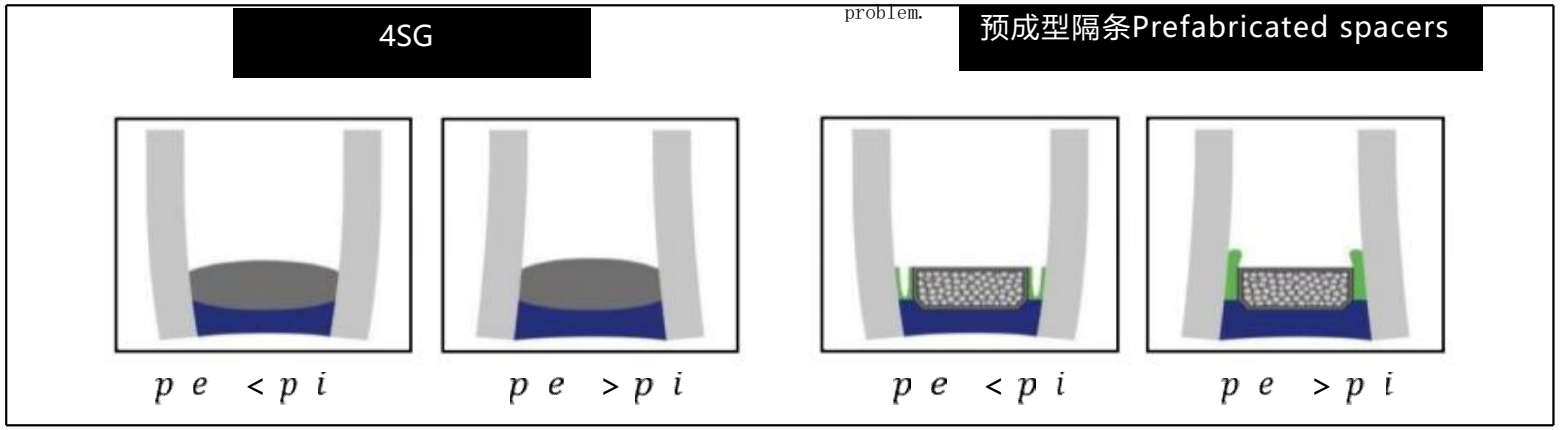
Ultimate beauty - no internal overflow problem

温度、 气压、 风压、 装配压力的不断变化使得预成型隔条中空系统会产生丁基内溢的问题， 特别是在玻璃安装的两 三年后尤为明显。

结构缺陷对于预成型隔条中空系统， 内溢的问题会伴随终身， 无法避免， 但 **4SG系统由于是完整的弹性密封隔条系 统将完全避免此问题的发生。**

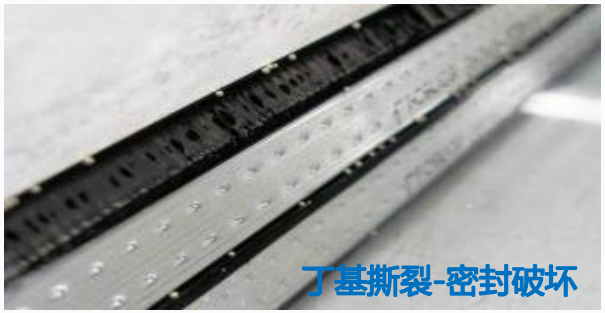
Constant changes in temperature, air pressure, wind pressure, and assembly pressure can cause problems with butyl internal overflow in prefabricated spacer insulating glass systems, especially after two or three years of glass installation.

Structural flaws For prefabricated spacer insulating glass systems, the problem of internal overflow will accompany them for life and cannot be avoided. However, the 4SG system is a complete elastic sealed spacer system that will completely avoid this problem.

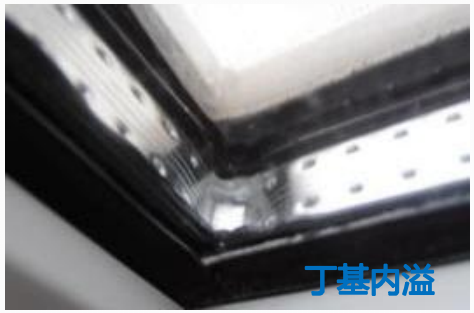


pe：外压 External pressure

pi：内压 Internal pressure



Butyl tear - Seal



Butyl internal

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04

经典案例

Classic Case

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经典案例
Classic case

查斯顿购物中心，墨尔本，澳大利亚

密封胶: Ködispace 4SG, GD 920,

中空玻璃生产商: Schollglas AG

幕墙公司: Seele GmbH

竣工时间: 2016

详细信息: ▪ 南半球最大的购物中心

▪ 2.172 IGUs (1,2 – 8 sqm) ▪ 260m

(7.080 sqm) 长度玻璃屋顶

▪ GEWE-Therm 4SG

Chadstone Shopping Center, Melbourne, Australia

Sealant: Ködispace 4SG, GD 920,

Insulating Glass Manufacturer: Schollglas AG

Curtain Wall Company: Seele GmbH

Completion Date: 2016

Details: ▪ Largest shopping center in the southern hemisphere

▪ 2,172 IGUs (1.2 - 8 sqm) ▪ 260m (7,080 sqm) long glass roof

▪ GEWE-Therm 4SG

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经典案例
Classic case

Car Dealer, Louwman Cars, NL

密封胶: Ködispace , GD 116

中空玻璃生产商: Flachglas Wernberg

竣工时间: 2004

详细信息:

- 约 4100 sqm
- 6/16/6 Pilkington INFRASTOP® Brillant

Car Dealer, Louwman Cars, NL

Sealant: Ködispace , GD 116

Insulating Glass Manufacturer: Flachglas Wernberg

Completion Date: 2004

Details:

- Approx. 4,100 sqm
- 6/16/6 Pilkington INFRASTOP® Brillant

POHOLL 鹏昊
4•S•G IG SYSTEM

经典案例
Classic case

Serlachius 艺术博物馆，芬兰

密封胶: Ködispace 4SG, Ködiglaze

中空玻璃生产商: Seloy Oy

竣工时间: 2014

详细信息:

结构装配和U型材装配

Serlachius Art Museum, Finland

Sealant: Ködispace 4SG, Ködiglaze

Insulating Glass Manufacturer: Seloy Oy

Completion Date: 2014

Details:

Structural assembly and U-profile assembly

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经典案例
Classic case

希尔顿酒店 阿斯塔纳, 哈萨克斯坦

密封胶: Ködispace 4SG
Ködiglaze S
GD 115
GD 826 N

中空玻璃生产商:Fa. SSK

竣工时间: 2016

详细信息: - 面积约 1.700 m²

Hilton Hotel Astana, Kazakhstan

Sealant: Ködispace 4SGKödiglaze SGD 115GD 826 NInsulating Glass Manufacturer: Fa. SSK

Completion Date: 2016

Details: - Approx. area of 1,700 m²

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经典案例
Classic case

国宝典藏 住宅, 大连, 中国

密封胶: Ködispace 4SG, GD 116

竣工时间: 2012

详细信息:

- 约 6.000 sqm
- 大连价值最昂贵楼盘
- 每户面积 411 -532 sqm

National Treasure Collection Residence, Dalian, China

Sealant: Ködispace 4SG, GD 116

Completion Date: 2012

Details:

- Approx. 6,000 sqm
- The most expensive real estate in Dalian
- Each household area is 411-532 sqm

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For Energy Saving

THANKS!

新一代中空密封技术革命

The new generation of
insulated seal technology
revolution