Safety Application of High Performance Silicone Sealant in Curtain Wall

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Guangzhou Baiyun Chemical Industry

August 24th, 2017
Outline

- Safety Application of High Performance Silicone Structural Sealant
- Safety Application of High Performance Silicone Weatherproofing Sealant
- The Correct Selection and Use of Sealants
- About Baiyun
Application of High Performance Silicone Structural Sealant
International Finance Centre (IFC), Guangzhou
4-Sided Structural Glazing

Super high-rise building with 440 Meters
Large unit size: 1.5m width × 4.5m height
Built in 2008
Silicone structural sealant: BaiYun SS922
Guangzhou IFC

• Unit size: 1500mm × 4500mm
• Laminated insulating glass: 8+1.52PVB+10+12A+10
• Maximum wind pressure: +3.251/-6.240Kpa
The structural bite for windload (live load) is calculated as follows:

\[ C_{s1} = \frac{wa}{2000f_1} \]

- \( C_{s1} \) ---- structural bite (mm);
- \( w \) ---- design windload (kN/m\(^2\));
- \( a \) ---- short span length of glass (mm);
- \( f_1 \) ---- sealant design strength, with value of 0.2 N/mm\(^2\).

(It is the same as the value of design tensile strength 139kpa in ASTM 1401 in nature)
Structural Bite Calculation

JGJ 102-2003
China Specification
4-Sided and 2-sided Structural Glazing

The structural bite for windload and horizontal seismic action is calculated as follows:

\[ C_{s2} = \frac{(w + 0.5q_E)a}{2000f_1} \]

- **Cs2** ---- structural bite (mm);
- **w** ---- design windload (KN/m²);
- **Q_E** ---- design seismic load (KN/m²);
- **a** ---- short span length of glass (mm);
- **f_1** ---- sealant design strength, with value of 0.2 N/mm².

(It is the same as the value of design tensile strength 139kpa in ASTM 1401 in nature)
Structural Bite Calculation

The structural bite for dead load is calculated as follows:

\[ C_{s3} = \frac{q_G ab}{2000(a + b) f_2} \]

- \( C_{s3} \) --- structural bite (mm);
- \( q_G \) --- unit weight of glass (KN/m\(^2\));
- \( a \) --- short span length of glass (mm);
- \( b \) --- long span length of glass (mm);
- \( f_2 \) --- sealant dead load design strength, with value of 0.01 N/mm\(^2\).
  (It is the same as the value of dead load strength 7kpa in ASTM 1401 in nature)

The structural bite should take the maximum value of \( C_{s1} \), \( C_{s2} \), and \( C_{s3} \).
Structural Bite Calculation

Guangzhou IFC
Regular design by JGJ 102-2003 (China Specification)

Bite > 40mm

The Bite dimension is beyond the specification and also unacceptable by developer.
# Standards for Silicone Structural Sealant

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Tensile Strength /MPa</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23°C</td>
<td>≥0.60</td>
<td>≥0.345</td>
</tr>
<tr>
<td>90°C</td>
<td>≥0.45</td>
<td>≥0.345(88 ℃)</td>
</tr>
<tr>
<td>-30°C</td>
<td>≥0.45</td>
<td>≥0.345(-29 ℃)</td>
</tr>
<tr>
<td>Immersion</td>
<td>≥0.45</td>
<td>≥0.345</td>
</tr>
<tr>
<td>Water – Ultraviolet</td>
<td>≥0.45 (300h)</td>
<td>≥0.345 (5000h)</td>
</tr>
<tr>
<td>Adhesive failure area , %</td>
<td>≤5</td>
<td>/</td>
</tr>
<tr>
<td>Maximum strength elongation , %</td>
<td>≥100</td>
<td>/</td>
</tr>
</tbody>
</table>
Super and High Performance Silicone Structural Sealant?
<table>
<thead>
<tr>
<th>Product</th>
<th>SS922</th>
<th>SS921</th>
<th>SS628</th>
<th>SS521</th>
<th>China Standard</th>
<th>ASTM Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items</td>
<td>ETAG 002</td>
<td>GB 16776</td>
<td>GB 16776</td>
<td>GB 16776</td>
<td>GB 16776 2005</td>
<td>ASTM 1184</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23°C</td>
<td>≥1.5</td>
<td>≥0.90</td>
<td>≥0.60</td>
<td>≥0.345</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90°C</td>
<td>≥1.0</td>
<td>≥0.90</td>
<td>≥0.45</td>
<td>≥0.345</td>
<td></td>
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</tr>
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<td>≥1.0</td>
<td>≥0.60</td>
<td>≥0.45</td>
<td>≥0.345</td>
<td></td>
<td>≥0.345(5000h)</td>
</tr>
<tr>
<td>Maximum strength elongation, %</td>
<td>≥200%</td>
<td>≥100%</td>
<td>≥100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adhesive failure area, %</td>
<td>≤5</td>
<td>≤5</td>
<td>≤5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength retention under various conditions</td>
<td>≥75%</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
# Super Performance Structural Sealant (SS922)

<table>
<thead>
<tr>
<th></th>
<th>China Standard</th>
<th>SS921/SS922</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile strength/MPa</strong></td>
<td>≥0.6</td>
<td>≥1.5</td>
</tr>
<tr>
<td><strong>Design tensile strength (ASTM)</strong></td>
<td>Designed by China Standard</td>
<td>Designed by China Standard</td>
</tr>
<tr>
<td>$f_1$ (N/mm²)</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Dead load strength (ASTM)</strong></td>
<td>0.14 (139KPa)</td>
<td>0.14 (139KPa)</td>
</tr>
<tr>
<td>$f_2$ (N/mm²)</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Design safety factor</strong></td>
<td>4.0</td>
<td>≥8.0</td>
</tr>
<tr>
<td><strong>Width of structural sealant</strong></td>
<td>$c_s$</td>
<td>$c_s$</td>
</tr>
</tbody>
</table>

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Design Solution (Guangzhou IFC)

• Super Performance Structural Sealant (Baiyun, SS922)
  • Improve structural design tensile strength \((ASTM)\) to 0.28 MPa;
  • Improve structural sealant dead load strength \((ASTM)\) to 0.014 MPa
  • Calculated in the standard requirements of 24mm range, finally used the maximum value of 24mm.

Auxiliary safety measures are added to ensure safety, like safety clip, etc.
safety clip

Holding object

8(HS)+1.52PVB+10(HS)
+12AIR+10(HS)夹胶中空玻璃
双镀LOW-E膜位于第四面
美好未来
卓越人生
纵向通长安全夹
Guangzhou IFC

The curtain wall has been used for **nearly 10 years** with excellent performance.

It is also **the highest 4-sided Structural Glazing project in the world at that time**.
High Performance Weather-proofing Sealant
Weather-proofing Sealant

**Features:**

- **Movement capability**
- **Weathering resistant**

**Movement capability**

- Capability of undertaking movement of joints.
- **Movement capability of weatherproofing sealant:** 25 Class, 35 Class, 50 Class, 100/-50 Class.
- the higher class, the better performance.
Select High Performance Weather-proofing Sealant to ensure the quality and permanently sealing
## Super Performance Weather-proofing Sealant

<table>
<thead>
<tr>
<th>Product</th>
<th>Displacement capacity</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS911</td>
<td>+100/-50 class</td>
<td>high rise curtain wall; large size unit curtain wall</td>
</tr>
</tbody>
</table>

- **100/-50 Class is the highest**
TianNing Royal Hotel, Saipan

Hurricane and earthquake zone;
Baiyun SS911 was used in the curtain wall for repairing of the hotel in 2004.
8 years later
### 2012 年白云胶工程回访调查表

A Questionnaire about the Projects using Baiyun Sealants

First of all, thank you all for your support. The purpose of this investigation is to check the performance of Baiyun sealants in all projects after their actual environment testing for a long time, and we will try our best to make some better adjustment for the features of Baiyun sealants. Sorry to take you valuable time, and thanks again for your assistance.

<table>
<thead>
<tr>
<th>工程名称</th>
<th>Project Name</th>
<th>工程地址</th>
<th>Project Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tinian Dynasty Hotel &amp; Casino</td>
<td>天宁皇家赌场酒店及赌场</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### On-site investigation for the sealant performance in 2012

美好未来 卓越人生

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二、幕墙或门窗使用情况（单选）
Curtain wall or windows Situation
（Single Choice）
1. 是否存在漏水情况 Did any leaking happen？
   A. 无漏水现象 No leaking
   B. 局部轻微漏水 Minor leaking
   C. 大面积轻微漏水 Minor leaking over large area
   D. 严重漏水 over large area

2. 是否存在玻璃破裂情况 Were there any damage happening to the glass？
   A. 完好无损 It's Fine
   B. 偶有破裂 Little fracture
   C. 大面积破裂 Large area fracture
   D. 更换不坏 Broken many times.

3. 是否存在中空玻璃失效 Were there any problem with the glasses broken？
   A. 中空玻璃完好 It’s fine
   B. 偶有结露现象 Little condensation
   C. 湿度凝结在玻璃 condensation in glass
   D. 大面积水 Large area with water

三、现场检查情况（多选）
Scene inspection situation （Multiple-choice）
1. 耐候性是否存在如下情况 Did any happen to weather-proofing sealant below？
   A. 耐候性好 Good elasticity
   B. 变硬、变脆 Harden, embitterment.
   C. 粘结不良 Bad Adhesion
   D. 开裂 Cracking
   E. 粉化 E. pulverization
   F. 变色 F. Change color

2. 结构胶是否存在如下情况 Did any happen to structural silicone sealant below？
   A. 强度和弹性好 Good strength and elasticity
   B. 变硬、变脆 Harden, embitterment.
   C. 粘结不良 Bad Adhesion
   D. 开裂 Cracking
   E. 粉化 E. pulverization
   F. 变色 F. Change color

四、调查结论（单选）
Investigation Result （Single Choice）
美好未来 卓越人生
Pollution of Curtain Wall
Exhibition Center in Haikou, China
When it was just finished
When it was just finished
Several months later
Using stain-resistant weather-proofing sealant to keep the curtain wall clean and long-term sealing
Solution (stain-resistant weather-proofing sealant)

- SS818 silicone stain-resistant weather-proofing sealant:

1. No pollution to the glass, aluminium, stone curtain wall;

2. Reducing the surface streaking and keep curtain wall clean;

3. Excellent weather resistance;

4. ±50% joint movement capability.
A Project in Guangzhou, 2014

SS818 used for facade renewal of the building
The Polluted Surface before Renewal, 2014

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The Correct Selection and Use of Sealants
The Whole Solution of Safety Application

Products

Service
Whole-Process Service

- **Pre application**
  - design consultation, drawing review, sealant recommendation and solution
- **During the application process**
  - adhesion test, compatibility test, application skill training
- **During the application process**
  - Quality control during application (Peel off testing)
- **After application**
  - Provide quality assurance
Whole-Process Service

Sealant Application Skill Training

Peel off testing report
About Baiyun
BAI YUN was set up in Guangzhou.

BAI YUN was in charge of writing the first China National Standard of silicone structural sealant. (GB16776-1997).

50 Years durability testing of silicone sealant was set up.

BAI YUN designed the China's first world class automatic continuous silicone sealant production line.

BAI YUN passed the ISO90001/ISO14001/OHSAS18001 by BSI.

BAI YUN developed Super Performance Silicone Structural sealant which the tensile strength exceed 1.5Mpa.

BAI YUN developed the green, intelligent, fully automatic production line which lead the production development in the world.

BAI YUN is the silicone sealant manufacturer having approved CNAS laboratory which test capacity can cover the China standard/ISO/ASTM and ETAG standards.

Post-doctoral research station was authorized to be set up in BAI YUN.

BAI YUN was in charge of writing the first China National Standard of silicone structural sealant. (GB16776-1997).
Project in Thailand

Project: Canapaya Residence Tower  
Developer: Canapaya Property Co., Ltd.  
Architecture: Palmer & Tunner  
Storey: 57 storeys (270m height), top 5 highest building in Thailand.  
BAI YUN Silicone Model: SS922, SS622, SS811.
Project in Philippines

Project: Double Dragon Plaza
Developer: DoubleDragon Properties Corp
Architect: Design coordinates
Consultant: ALT Cladding
Contractor: Aluace Corporation
BAI YUN Silicone Model: SS622/SS818/SS811E
Project in Philippines

Project: East Gallery Place
Developer: Ayala Land Premier
Architect: GF PARTNER
Consultant: ALT Cladding
Contractor: Aluace Corporation
Products: SS622/SS811E
Project in Philippines

Project: Tera Tower  
Developer: Robinsons Land Corporation  
Consultant: ALT Cladding  
Contractor: Aust Phils  
Products: SS622/SS811E
Project in Myanmar

Project: Time City
Developer: Crown Advanced
Contractor: Crown Advanced Construction Co., Ltd
Products: SS622/SS811/SS821
Project in Malaysia

JKG Tower
Consultant: Meinhardt
Contractor: Angkasa Jasa
Product: SS821 Clear Silicone Structural Sealant
Built in: 2016
Address: Jln Raja Laut/Jln TAR, Kuala Lumpur.
Conclusion

- High-performance structural sealant can provide more solutions and higher safety factors for the curtain walls;

- High-performance weather-proofing sealant ensures better durability of curtain walls and keeps the curtain wall clean and free from contamination;

- Select good sealants and make good application as well.
Excellent solutions and service help customers get more excellent projects, and more trust and reputation from clients.
Thank you!

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