Kömmerling „GD 116“ polysulfide sealant

Quality control measures for the insulating glass production

Part 1    Factory Production Control (FPC)

EN 1279 part 6 prescribes the requirements for the FPC measures. In annex A the various insulating glass systems and designs are described. The corresponding appropriate FPC procedures, tools and materials, the pass fail criteria as well as the frequency of inspection are outlined. Three distinct areas are identified as follows:

► Goods inwards checks  ▼ Checks during production  ◄ Final goods inspection

The following is intended to aid the manufacturer to gain the maximum benefit and the greatest production safety when using GD 116. The test procedures are all tried and tested. We assume that the user is familiar with the standard EN 1279 and especially part 6.

Part 2    Additional Recommendations and trouble shooting guidance

These recommended tests are not intended to replace any standards, codes of practice, system tests but are intended to complement them. Manufacturers are advised to check which additional local requirements have been set out.
Recommendation for the factory production control using GD 116

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Recommendation for the factory production control using GD 116

Chemische Fabrik GmbH

Part 1  Factory Production Control (FPC)

► Goods inwards check

as an example: Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer.

EN 1279.6 Annex A, Table A2, Section 1: Material control (Ref. 7) Outer seal

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Packaging and labeling</td>
<td>Visual</td>
<td>See purchase specification</td>
</tr>
</tbody>
</table>

- The packaging should be visual inspected for damage
- Labels to be compared to delivery note
- Eliminate the possibility of confusing different sealant types

Packaging undamaged.  
Packaging damaged. !!

correct label

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>Shelf life</td>
<td>Visual</td>
<td>See purchase specification</td>
</tr>
</tbody>
</table>

- Confirm „use by date“ on label.

GD116 A

KÖMMERLING

Made in Germany

190 L 81656 695

Technical data:

- Material content:
- Service life:
- Temperature range:
- Pressure range:
- Dimensions and tolerances:
- Weight:
- Accessories:

KÖMMERLING Chemische Fabrik GmbH - 79624 Freiburg - Germany - Phone (+49) 761 293 80 - Fax (+49) 761 293 810
Recommendation for the factory production control using GD 116

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3a</td>
<td>Adhesion on glass and on spacer (not needed for structural seals)</td>
<td>Adhesion test (F.3)</td>
<td>Refer annex F.3.3</td>
</tr>
</tbody>
</table>

**Adhesion to spacer with Test-Device**

- Seal 2 clean spacer with sealant and avoid air bubbles.
- Dimensions of the sealant: height ≥11.5 mm x length 20 mm x width of the spacer.
- Allow it to cure for 24 h and fix the sample into the device
- The device places a load of 0.3 N / mm² on the sample.
- The requirements are fulfilled if the sample does not fail after a load period of 10 minutes.

**Adhesion to glass with Test-Device**

- Seal 2 clean glasses with sealant and avoid air bubbles.
- Dimensions of the sealant: height ≥11.5 mm x length 20 mm x width (e.g. 12 mm)
- Allow it to cure for 24 h and fix the sample into the device
- The device places a load of 0.3 N / mm² on the sample.
- The requirements are fulfilled if the sample does not fail after a load period of 10 minutes.

*Note: this test deviates from the standard in terms of the glass dimension and the sealant thickness. The area of adhesion is identical. We believe that this test will yield the same results as the test described in the standard.*

**Alternative***:

**Testing adhesion to glass with the Butterfly test**

(Use only if the cohesive strength is known and acceptable)

- Take the two pieces of glass in the smallest dimension which will pass down your line.
- Wash and dry the glasses in the washer.
- Center spacer frame between the two pieces of glass and press.
- Seal two opposite sides.
- After curing for 24 h at room temperature (> 20°C) the test can be performed.
- Cut one piece of glass down the center and break. Fold open the sample as shown into position B during 10 seconds.

*Note: when this test is performed concurrently with the spacer test described in 7.3a with the same batch combination the cohesive strength is assured. We believe that this is sufficient that this test is sufficient to ensure adequate glass adhesion.*
### 7.3b Adhesion on glass (edge seals for structural purposes)

<table>
<thead>
<tr>
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<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3b</td>
<td>Adhesion on glass (edge seals for structural purposes)</td>
<td>Tensile test</td>
<td>prEN 13022</td>
</tr>
</tbody>
</table>

- See EN 1279-4.
- *Not relevant for non-structurally glazed insulating glass with GD 116*

### 7.4 Hardness may be combined with section 2, “Production control”

- We recommend that this is only done as part of the production checks.

### 7.5 Volatile content (if no manufacturers info is available)

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>Volatile content (if no manufacturers info is available)</td>
<td>Weight loss</td>
<td>See purchase specification</td>
</tr>
</tbody>
</table>

- No testing by customer required → Confirmation is contained in Certificate of conformity.
▼ Production control

as an example: Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer

**EN 1279.6 Annex A, Table A2, Section 2: Production control (Ref. 7) Outer seal**

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Adhesion, (not needed for structural seal)</td>
<td>Annex F (if possible Butterfly test)</td>
<td>Annex F3, F4.1 or F4.2</td>
</tr>
</tbody>
</table>

- **F.3 „Testing glass adhesion with test-device“** see page 4
- **F.4.2 „Testing glass adhesion with Butterfly test“** see page 4
- **F.4.1 „Tensile testing to EN 1279-4“** see EN 1279-4 (5.1)

<table>
<thead>
<tr>
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<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2</td>
<td>Adhesion (edge seals for structural purposes)</td>
<td>Tensile test to EN 1279-4</td>
<td>prEN 13022</td>
</tr>
</tbody>
</table>

- **See EN 1279-4.**
- **Not relevant for non-structurally glazed insulating glass with GD 116**
Recommendation for the factory production control using GD 116

Chemische Fabrik GmbH

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3</td>
<td>Mix ratio</td>
<td>See specification of sealant and equipment manufacturers</td>
<td>See sealant specification</td>
</tr>
</tbody>
</table>

→ Specification
- The correct mixing ratio of GD 116 is 10 parts base to 1 part hardener by volume and 10 parts base to 0.88 parts hardener by weight.
- The mix ratio may not deviate by more than ± 20%.
- The mix ratio may be determined by one of the following methods:

→ Recommendations:
A: Weighing components dispensed from the sampling ports

In order to obtain a reasonably correct result, a large quantity of A-component should

1. Determine and record the weight of the empty containers.
2. Open both valves (A & B) at the same time.
3. Weigh the containers with sealant and respective take off tare.
4. Calculation of the mixing proportion

Example: (A-comp. = 550 g and B-comp. = 48 g)
Question: Mixing ratio = 10 : X

\[ X = 10 \times \frac{B}{A} \]
\[ X = 10 \times \frac{48}{550} \]
\[ X = \frac{540}{550} = 0.873 \]

Note: If the machine features counter pressure devices (to simulate the back pressure) these should be set correctly to the pressures indicated during normal gunning. If in doubt consult with the machine supplier.

B: Calculation of the mixing ratio by measuring the movement of the pressing plate “Multiplier 2.41”

Due to the different diameters of A and B drums and pails and due to the mixing ratio of 10:1 by volume, you will find a multiplier A:B of 2,41 : 1. The proportion of the distances of both following plates from first to second measuring must be 2.41 : 1.

Example:
If the following plate of A-component came down by 22.5 cm and following plate of B-component came down by 9.3 cm, you have to divide 22.5 by 9.3 and you will get 2.419

Extreme value with 5% over- or under-dosing:
- Plus 5% B-component (too much B-component in the mixture) → 2.30
- Minus 5% B-component (less B-component in the mixture) → 2.54

C: Determination according manufacturers instructions.

Refer to manufacturer’s instruction.
7.4 Thoroughness of mixing

**Recommended Method** (decision made by manufacturer)

Mixing check (Annex D)

**Requirement**

No marbling

→ Description to Annex D:

- 2 clean and dry pieces of 4 mm float glass, size ca. 250 x 150 mm. Place ca. 10 g of freshly mixed sealant from machine. Press uniformly by hand. Visual inspection under bright light after 5 minutes.
- The sample should be uniform in appearance. There may be no obvious steaks.

7.5 Air inclusions (during 7.4 thoroughness of mixing)

**Requirement**

No air inclusions

- Sealant should be free of bubbles

7.6 Hardness

**Recommended Method** (decision made by manufacturer)

Hardness test (Annex E)

**Requirement**

See product description

→ Description to annex E:

- Prepare a sample from mixed sealant with a diameter of at least 50 mm and a minimum thickness of 6 mm. The surface must be even.
- Standard curing conditions:
  - a) 60 ± 5 min. at 60°C;
  - b) 24 h ± 0.5 h, ambient conditions in factory
  - c) 168 h ± 0.5 h, ambient conditions in factory
- testing after cooling down (a) = 60 ± 5 min; (b und c) 10 ± 2 min
- test parameter: Exert pressure of the Shore A instrument N (5 kg ± 0.1 kg); take reading after 1 second

→ Recommendation line with Kömmerling method:

In order to create defined conditions, simply one glass plate and three pieces of spacer bars (6.5 mm height) can be used.

- Apply sealant bubble free to the glass surface
- Place a piece of spacer on either side.
- Flatten the surface with a third piece of spacer

Determination of the hardness Shore A after 24 h curing time.

- Place sample on a firm base
- Bring Shore A device in an upright position
- Press with a force of approx. 1 kg
- Record the value after 3 seconds
Recommendation for the factory production control using GD 116

Chemische Fabrik GmbH

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>7.7</td>
<td>Contamination</td>
<td>Visual</td>
<td>See purchase specification</td>
</tr>
</tbody>
</table>

- The base or part A must be beige in appearance and free of contaminations and debris in the surface.
- The hardener must be black, pasty and have a clean surface.

Final goods inspection

as an example:
Inspection and test table for air-filled organic sealed insulating glass units with hollow spacer

EN 1279.6 Annex A, Table A2, Section 3: Product control (Ref. 2) “Outer seal” and (Ref.9) “Fogging”

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Dimensions</td>
<td>Measurement</td>
<td>See product description</td>
</tr>
</tbody>
</table>

- The dimensions must conform to the system description

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2</td>
<td>Occurrences exceeding absolute limits</td>
<td>Visual</td>
<td>See product description</td>
</tr>
</tbody>
</table>

- The tolerances must conform to the system description.

<table>
<thead>
<tr>
<th>Ref.</th>
<th>Material, inspection or test</th>
<th>Recommended Method (decision made by manufacturer)</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Fogging (this test relevant when no information exists on the volatile content of the relevant components)</td>
<td>Annex C</td>
<td>No visible fogging</td>
</tr>
</tbody>
</table>

- The volatile content is given in the Certificate of conformity
Part 2  Additional recommendations and trouble shooting

The influence of temperature on GD 116
during transport and storage

Temperature influences the viscosity of the sealant. The viscosity is very important for the process ability.

- **Low temperatures**  ------  **high viscosity**  ---------  **sealants becomes thick**
  In this case the pressure in all the pumps increases and possibly activates the excess pressure protection

- **High temperature**  ------  **low viscosity**  ---------  **sealant becomes fluid**
  In this case, the non-sag behavior of the sealant decreases. The flow behavior changes and the adjustment of the machine become difficult.

Transport
The sealants are not frost sensitive but the sealant should be allowed to adapt to room temperature prior to use. This may take several days.

Storage
To ensure the sealant retains its processing properties over the quoted shelf life it has to be stored in cool and dry conditions. The perfect storage temperature is between **10°C and 25°C**. The sealant should not be exposed to direct sunlight for lengthy periods.

Processing
Note the optimum processing temperature differs from the storage conditions. The optimum processing temperature is between **15°C and 30°C**.

Warm-up (guide values)
Due to a low thermal conductivity of sealants, the warm-up time can be quite long. For example: A drum that has cooled down to 10°C needs about 7 to 8 days at temperatures of 20°C to come to a temperature of 15°C. If it is just 5°C the warm-up time comes to 14 days, etc.

*In most cases, the drums are exposed to low temperatures only for a short time. Here it is just the edge area of the drum that cools off. The center of the sealant (mid of the drum) is more or less unaffected. For example: 2 to 3 days in cool conditions leads to 2 to 3 days of warming up at room temperatures.*
„Trouble shooting“ with GD 116

1. Mixing uniformity (marble effect)

<table>
<thead>
<tr>
<th>Homogenous mixture</th>
<th>slight shades</th>
<th>clear noticeably stripes</th>
</tr>
</thead>
<tbody>
<tr>
<td>-good- ✗</td>
<td>-still acceptable- i</td>
<td>-bad- X</td>
</tr>
</tbody>
</table>

Repeat this test after producing of another 20 to 30 IG units

1.1 Causes for a bad mixing picture

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocked static mixer</td>
<td>Poor mix of A and B-component</td>
<td>Clean the mixer</td>
</tr>
<tr>
<td></td>
<td>Pressure ratio of the machine could change</td>
<td>Change the mixer</td>
</tr>
<tr>
<td></td>
<td>A or B-component shoots forwards</td>
<td></td>
</tr>
<tr>
<td>Non –return valve operation fault</td>
<td>Discontinuous flow of A- and/or B-component</td>
<td>Clean or change valve</td>
</tr>
<tr>
<td>B-Filter (Pump) blocked</td>
<td>Less B- component in the mixture</td>
<td>Clean or change filter</td>
</tr>
<tr>
<td>Ø of the static mixer to small</td>
<td>B- component flows along the gap between pipe/tube and static mixer</td>
<td></td>
</tr>
<tr>
<td>Static mixer too short or mixing elements missing</td>
<td>Bad uniformity of the mixture</td>
<td>Use more or longer static mixers</td>
</tr>
</tbody>
</table>

2. Mixing ratio (One component is used up before the other)

<table>
<thead>
<tr>
<th>Causes for a wrong and/or varying mixing ratio</th>
<th>Effect</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrong set up of the machine (GD 116 10 : 1 by volume)</td>
<td>Continuous dosing failure</td>
<td>Set up the machine to 10 :1 by volume</td>
</tr>
<tr>
<td>Frequently purging with A-component</td>
<td>High consumption of A-component, high amount of remaining B. component</td>
<td>Optimizing of production process (less interruptions)</td>
</tr>
<tr>
<td></td>
<td>Backflow of A- or B-component</td>
<td>Shorter breaks</td>
</tr>
<tr>
<td>Malfunction of a valve</td>
<td>Discontinuous flow of A- and/or B-component</td>
<td>Clean or change valve</td>
</tr>
<tr>
<td>Worn or leaky gasket</td>
<td>Sealing material is pumped not in sufficient quantity</td>
<td>Pull tight the seals (packings) and/or renew</td>
</tr>
</tbody>
</table>
### 3. Curing (slow)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Low temperature</td>
<td>• Slow curing (see product information)</td>
<td>• Bring the units in a warmer environment</td>
</tr>
<tr>
<td>• Wrong mixing ratio “too much hardener (B-comp.)”</td>
<td>• Curing behavior could be changed</td>
<td>• Set up the machine to 10 : 1 by volume</td>
</tr>
<tr>
<td></td>
<td>• no curing</td>
<td>• Repair the machine malfunction</td>
</tr>
<tr>
<td></td>
<td>• less shore A hardness etc.</td>
<td></td>
</tr>
<tr>
<td>• Wrong mixing ratio “less hardener (B-comp.)”</td>
<td>• Curing behavior could be changed</td>
<td>• Set up the machine to 10 : 1 by volume</td>
</tr>
<tr>
<td></td>
<td>• no curing</td>
<td>• Repair the machine malfunction</td>
</tr>
<tr>
<td></td>
<td>• less shore A hardness etc.</td>
<td></td>
</tr>
</tbody>
</table>

### 4. Shore A (too high, too low)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Effect</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Short curing time (&lt;24h)</td>
<td>• Low shore A hardness</td>
<td>• Allow it to cure 24h</td>
</tr>
<tr>
<td>• Low temperature</td>
<td>• Slow curing</td>
<td>• Store test sample at room temperature</td>
</tr>
<tr>
<td>• Surface of the test sample uneven (dent)</td>
<td>• Lower shore A hardness</td>
<td>• Look for plane surface</td>
</tr>
<tr>
<td>• Surface of the test sample uneven (hill, lump)</td>
<td>• Higher shore A hardness</td>
<td>• Look for plane surface</td>
</tr>
<tr>
<td>• Contact pressure too high</td>
<td>• Higher shore A hardness</td>
<td>• Limitation pressure on approx. 1kg limit</td>
</tr>
<tr>
<td>• Thin sealant layer</td>
<td>• Higher shore A hardness</td>
<td>• Limit the sealant thickness on 6 to 7 mm</td>
</tr>
<tr>
<td>• Thick sealant layer</td>
<td>• Lower shore A hardness</td>
<td>• Limit the sealant thickness on 6 to 7 mm</td>
</tr>
</tbody>
</table>

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Recommendation for the factory production control using GD 116

Chemische Fabrik GmbH
5. Adhesion (poor)
There are a lot of different reasons, which can affect the adhesion negatively.

5.1 Dirty spacer bar (e.g. dust, lubricant, grease, fingerprint, crème etc.)
Dust and grease etc. works as a barrier and can delay or permanently stop adhesion being formed.

5.2 Cold surfaces „condensation“
Especially in cold seasons a change of spacer bars and also glass, from cold into a warmer environment will be critical if this product is directly processed. On cold surfaces moisture condensates, forming a barrier layer and prevents a buildup of adhesion.

5.3 Low temperatures
At very low temperatures the curing of the sealant and also the development of adhesion is slowed down. A difference in temperature by 10°C doubles the cure time. Either store the samples at higher temperature or check adhesion correspondingly later.

5.4 Poor mixing of the sealant
An insufficient mixture of the components A and B, leads likewise to a negative result. Consider mixing uniformity!

5.5 Deviation in the mixing ratio
Large deviations from the mixing ratio lead to an impairment of the adhesion. Please note that a satisfactory curing performance may not necessarily indicate satisfactory adhesion. Therefore a daily examination should take place.

As mentioned, the reasons for poor adhesion may be a combination of the above factors. It is advisable to prepare a number of samples to inspect the adhesion after 24, 48 and 72 hours.

6. Excessive Slump (sealant „runny“)
This is usually caused by high material temperatures. Possible causes for excessive temperatures are:

- Drums stored in a hot environment
- Drums stored in direct sun radiation.
- Following plate heating set to higher than 30 °C.
- High ambient temperature.
7. Machine malfunction (pressure deviations, wrong dosage, variations, etc.)

In view of the large number of different specific types of equipment and technologies used, it is not possible to provide specific advice on individual machines. We suggest that the relevant machine documentation is consulted and a systematic fault analysis is undertaken.

- The snake test is a useful starting point for a comprehensive fault diagnosis, particularly for manual guns.

- Extrude a “snake” of sealant 1 – 2 m long onto cardboard or plastic sheeting. The honeycomb packers supplied with glass sheets are particularly suitable for this.

- Mark the switch points of the pumps (change from upstroke to down stroke of the pump piston)

- Allow the sealant to cure for 60 - 90 minutes. Check the hardness of the material every 5 cm by finger pressure. Record soft spots

- Check cure development hourly. Record soft spots

- Curing should be uniform
- Minor deviations in dosage can result in differences in initial cure.
- After 24h the sealant should have cured uniformly to the minimum Shore A hardness quoted in the technical documentation for the sealant.

Fault diagnosis: Should soft spots occur it is important to record their number.

a. Same number of soft spots as switch points: Dosing problem in each switch point (up- and down stroke)
b. Only half the number of soft spots as switch points: Dosing fault on either the up- or the down stroke)
c. Only one soft spot: Problem at the start or the stop of extrusion.
d. Random soft spots: random fault.

8. Hand mix – a first measure to exclude machine influences.

By excluding machine effects the performance of the sealant can be confirmed.

- Apparatus:
  Balance (1g resolution), paper cup or similar, stirring implement (dowel off cut or piece of spacer)

- Record weight of empty cup.

- Add 150 g A- and 13 g B-component GD 116 to the cup.

- Stir slowly for 5 minutes achieving a uniform mix.
- Check cure rate as previously described
- If required samples for checking the adhesion may be prepared.