TKK

GLASS EXPERT

GLASS INDUSTRY PRODUCTS


TKK

TKK

Our path to success is marked by our **commitment to excellence** and **responsibility** towards the **environment**.

Our rich history and continuous **development** have put us on the map of specialists in the production of high quality products in the field of construction chemistry.

With our wide sales network and subsidiaries in Croatia, Bosnia and Herzegovina, Serbia, Bulgaria, Hungary, and Greece we are a **leading producer** of sealants, polyurethane foams, adhesives and chemical admixtures for construction industry in South-East Europe with **annual turnover exceeding 120 million EUR.**

A 70-year-long tradition, innovation, flexible business model as well as experience and presence in **70+ countries around the world** allow us to constantly expand our range of products and adjust to the needs of our customers. Committed to excellence, the highest level of **responsibility** towards the environment and professional support and advice for our customers we will continue with our endeavours to remain the first pick of craftsmen both at home and abroad.

ADVANTAGES FOR OUR CUSTOMERS

RELIABLE AND PROMPT **DELIVERY**
On-time Delivery: Ensure your projects stay on schedule with our consistent and punctual delivery services.
Efficiency: Minimize downtime and keep your operations running smoothly with our reliable logistics.

24/7 SUPPORT
Around-the-Clock Assistance: Access our expert support team at any time to resolve issues swiftly.
Peace of Mind: Enjoy the confidence that comes with knowing help is always available whenever you need it.

PROFESSIONAL **CONSULTANCY**
Expert Guidance: Benefit from our seasoned consultants who provide tailored advice to enhance your business strategies.
Informed Decisions: Make smarter, data-driven decisions with insights from industry professionals.

RELIABILITY
Consistent Performance: Rely on our consistent service quality to meet your business needs without interruption.
Trustworthy Partner: Build a long-term relationship with a dependable partner committed to your success.

INNOVATIVE **DEVELOPMENT**
Cutting-Edge Solutions: Stay ahead of the competition with our innovative products and services that adapt to market changes.
Growth Opportunities: Leverage our expertise to drive your business growth and expansion.

STRONG **SOCIAL RESPONSIBILITY**
Ethical Practices: Align with a company that prioritizes ethical practices and contributes positively to society.
Community Engagement: Enhance your brand image by partnering with a socially responsible organization.

GLOBAL PRESENCE
International Reach: Expand your market reach with our global network and resources.
Local Expertise: Benefit from our local market knowledge and global capabilities.

SUPERIOR **QUALITY**
High Standards: Experience the best with our commitment to delivering high-quality products and services.
Customer Satisfaction: Achieve greater satisfaction with products and services designed to meet the highest standards.

SOLUTIONS FOR YOUR **PROBLEMS**
Problem-Solving Expertise: Quickly address and resolve your business challenges with our customized solutions.
Personalized Approach: Receive solutions specifically designed to meet your unique needs and requirements.

SEAMLESS **COMPATIBILITY**
Integration Ease: Ensure smooth integration with your existing systems and processes.
Flexible Solutions: Enjoy the flexibility of our products and services that are compatible with various platforms and technologies.

OUR STORY

Added value of our products is the result of long-standing tradition and experience.

1850 - excavation of chalk on the site of present TKK

1947 - the company Kreda is founded

1958 - the company starts producing glass putty

1977 - the company starts producing polysulphide- based sealants (Thiokol) used in the glass and construction industry

1986 - the company starts producing silicone-based sealants

1990 - the company Kreda is renamed TKK and becomes an independent joint-stock company

1992 - the company starts producing polyurethane foam

1996 - the company starts producing one-component silicone-based sealants for the manufacture of insulated glass units (Tekasil T)

1998 - the company starts producing primary PIB-based sealants

2005 - introduction of a new automated line for the production of silicone

2007 - the company starts producing polyurethane-based two-component sealants suitable for the manufacture of insulated glass units

2012 - the company starts producing two-component silicone suitable for the manufacture of insulated glass units

2013 - TKK becomes part of Soudal Holding NV Group

COMMITMENT TO QUALITY AND **CUSTOMERS NEEDS**

Ensuring the quality, durability, and reliability of our products starts with rigorous testing of the compounds used in manufacturing. Our comprehensive process includes the evaluation of tensile strength, rheological properties, and the critical mixing behavior of sealants.

Tensile testing is essential for assessing the mechanical properties of our materials. By subjecting them to controlled tension, we measure their resistance to stretching and breaking under load. This helps us ensure that our sealants have the strength and resilience needed to withstand the stresses and environmental factors that insulating glass will face over its lifespan.

Equally important is the **measurement of rheological properties**, such as **viscosity** and **thixotropy**. These properties play a crucial role in how our compounds behave during application and curing.

- **Viscosity** governs the flow of the material, which ensures consistent application and the formation of strong, reliable seals.
- **Thixotropy** allows the material to become more fluid when applied and return to a stable form at rest, ensuring ease of use without sacrificing structural integrity.

Furthermore, the **mixing properties of the A and B components** are key factors in determining the success of our materials. Many of our sealants for the production of insulating glass units are two-part systems, and achieving the correct balance in mixing is essential for realizing optimal tensile and rheological properties. Proper viscosity and thixotropy ensure consistent mixing, smooth application, reliable curing, and long-term performance. Any imbalance can negatively affect the compound's flow behavior and the final quality of the product.

Through the meticulous testing of **tensile, rheological,** and **mixing properties**, we ensure that our materials meet the highest industry standards for strength, ease of application, and durability. This thorough approach guarantees that the insulating glass produced with our materials will deliver exceptional energy efficiency, structural integrity, and longevity.

In conclusion, our commitment to continuous research and development (R&D) enables us to stay ahead. By constantly innovating and refining our materials, we ensure that we not only meet but exceed the expectations of our customers, providing solutions that are at the forefront of insulating glass technology.

Thank you for choosing our products. With our focus on quality, innovation, and market responsiveness, we are dedicated to delivering materials that you can trust for your most demanding applications.

TKK laboratory testing

Shore A hardness

Shore A hardness is evaluated by testing method based on standard SIST EN 1279-6:2018 annex E

1. Method

This control procedure determines the hardness of the material, which is an important mechanical property of sealing compounds. Hardness depends on the viscoelastic properties and modulus of elasticity of the material and is inversely proportional to the depth of the Shore meter needle.

Shore-A hardness is given as a relative value in the interval from 0 to 100.

2. Preparation of the sample

2K systems and filling compounds:

Prepared test pieces are aged according to annex E, namely for 1 day under standard conditions (T=23°C and rel. humidity=50%).

a. 1K systems:
b. Prepared test pieces are aged according to method C ISO 868, namely for 21 days under standard conditions (T=23°C and rel. humidity=50%).

The final thickness of the applied sample after aging must be min. 6 mm and diameter minimum 50mm.

The surface of the sample to be measured must be flat.

Fig1: Shore A meter with stand

3. Measurement

The sample is tested on a plane and firm base. The hardness is measured on the top surface with a contact force of approx 1kg.

The test piece is placed on the measuring plate of the Shore-A meter. The lever is slowly lowered onto the test piece so that the needle is min. 9 mm from the final edges and read the result. The measurement is made in 5 different places of the sample. The result is given as the average value of all measurements.

The reading should be taken within three seconds after full contact of the instrument with the sealant surface is achieved

4. Fact

Significant deviation from target values may indicate deviation from mixing ratio, air inclusion or inadequate curing conditions.

TKK laboratory testing

Adhesion on surface at constant load

Adhesion on surface is evaluated by testing method based on standard EN 1279-6:2018, *Glass in building – Insulating glass units – Part 6: Factory production control and periodic tests (Annex J).*

1. Method

Tensile test of H-samples according to EN 1279-6:2018 (Annex J) is used to evaluate the adhesion between sealant and spacer. Schematic representation of sample and its dimensions is shown in Fig. 1.

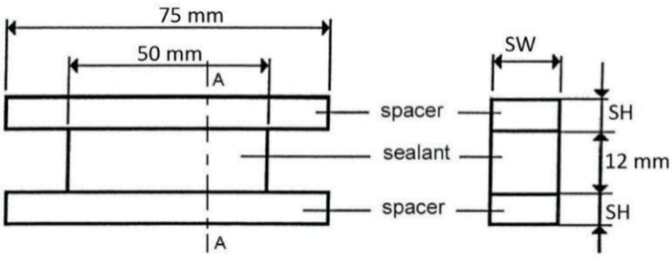


Fig. 1 Schematic representation of the sample (SW – spacer width, SH – spacer height)

After curing (24h), the samples are subjected to tensile tests using material testing machine *Zwick/Roell BT1-FB010TN.D30* in standard conditions[1].

Test samples are subjected to constant load mode (Fig. 2).

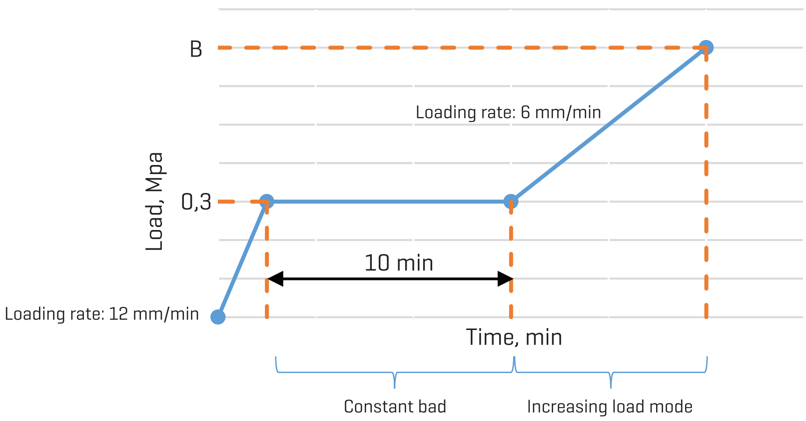


Fig. 2 Loading mode of the specimens (σ_B – tensile strength)

2. Constant load mode.

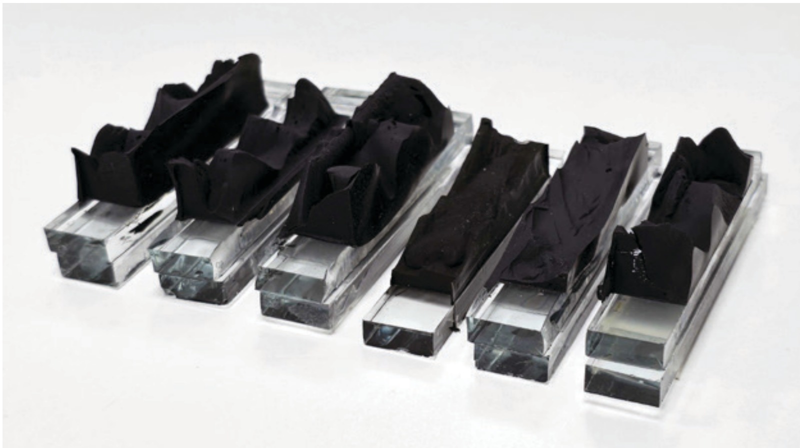
H-sample is subjected to the tensile load 0,3 MPa for 10 minutes. The sealant shall not show any failure/breakage during that time. <u>If the sample does not bear the constant loading, the sealant-spacer adhesion test is negative.</u>

The type of failure is documented, and a stress/strain diagram plotted.

Example:table 1

IGU secondary sealant		Spacer	
Product name	TKK Glass Expert Tioelast TM A 6	Product name	SunGuard SN 70/35
Product description	2-component, polysulphide polymer sealant	Manufacturer	Guardian
Product specification	R6-00/06.2023	Substrate material	Float glass
Batch number/ production date	Component A: 231048 / 26.05.2023 Component B: 23918 / 25.05.2023	W	

Results: Table 2

1 day at standard conditions		
Constant load mode at 0,3 MPa		
Adhesion test result	Positive	
Type of failure	No breakage	
Increasing load mode		
Tensile strength, MPa	0,53 MPa	
Type of failure	C10[2]	
1 day at standard conditions		

C – cohesive, T – thin film, A – adhesive; scale 0 – 10 which means 0 to 100% of surface area

TKK laboratory testing

Exposure to UV, moisture and temperature

1. Method:

Cured tests samples are exposed to UV radiation for approx. 504h . Intensity of the UV source in the UVA range is in accordance with EN 410 (40±5) W/m^{2}.. Maximum temperature on the exposed glass surface is not exceeding more than 65°C.

Fig. 1: UV chamber

After exposure to UV samples are placed in climate chamber with the temperature (58±1)°C and relative humidity 95% for 168h. After exposure samples are conditioned at room temperature for 24h. Samples are then tested in accordance to clause A.1 of the standard EN 1279-4:2018.

2. Facts:

- **a. UV exposure (+5000h UV) leads to photodegradation of polysulphide and polyurethane prepolymer.**
- **b. Silicone based sealants due to its molecular structure are fully UV resistant.**

TKK laboratory testing

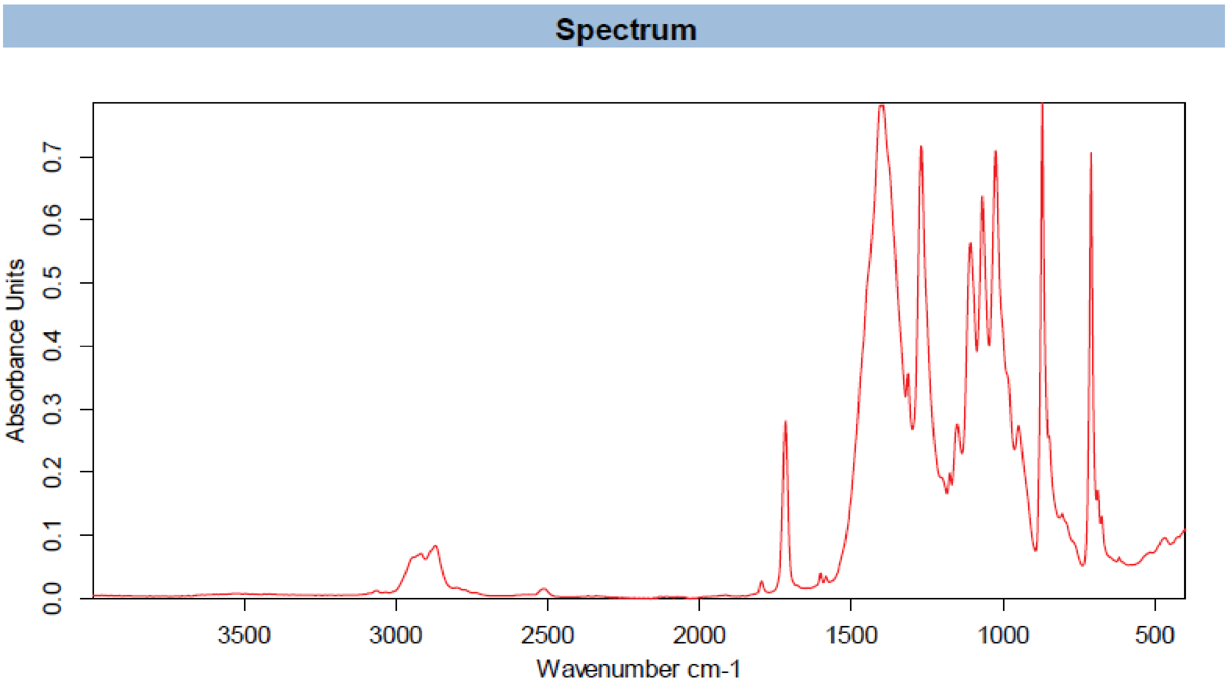
FTIR- Infrared spectrum

The evaluation of infrared spectrum of the sealant is based on standard EN 1279-6:2018 annex E

1. Method

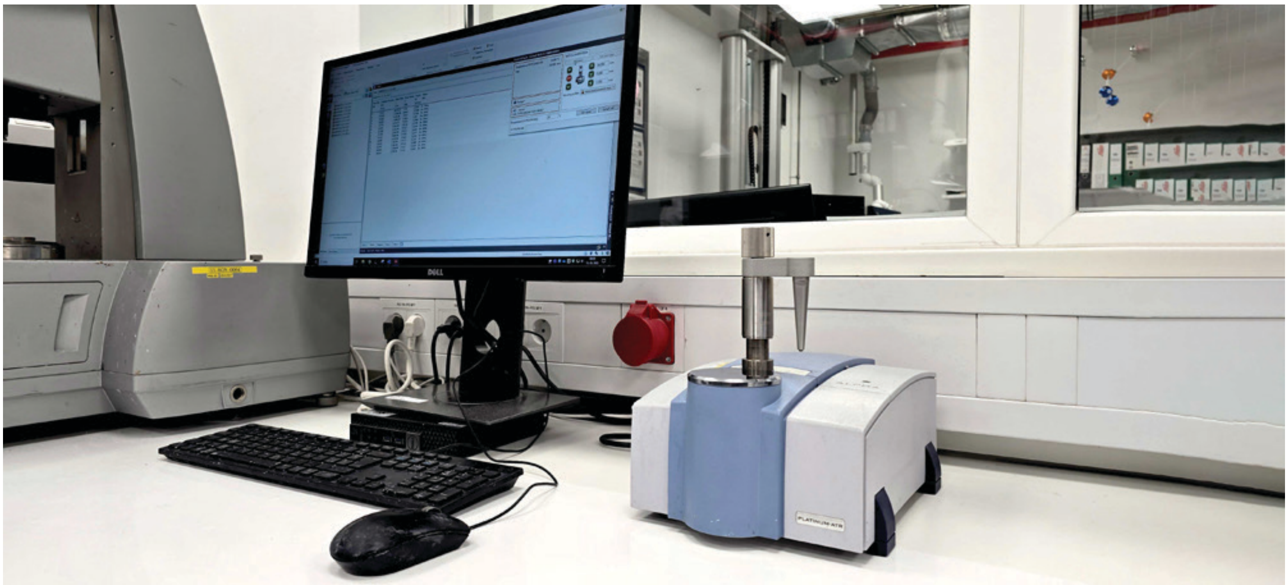
FTIR (Fourier-Transform Infrared) spectroscopy utilizing the Attenuated Total Reflectance (ATR) sampling technique offers a rapid and simple technique for the chemical characterization of the sealant in the range from 400 cm^{-1} to 4000 cm^{-1}

Fig. 1: FTIR specter



2. Facts:

Infrared specter is a fingerprint of the sealant. By knowing the formulation we can determine the basis and the quality rank of the sealant .



TKK laboratory testing

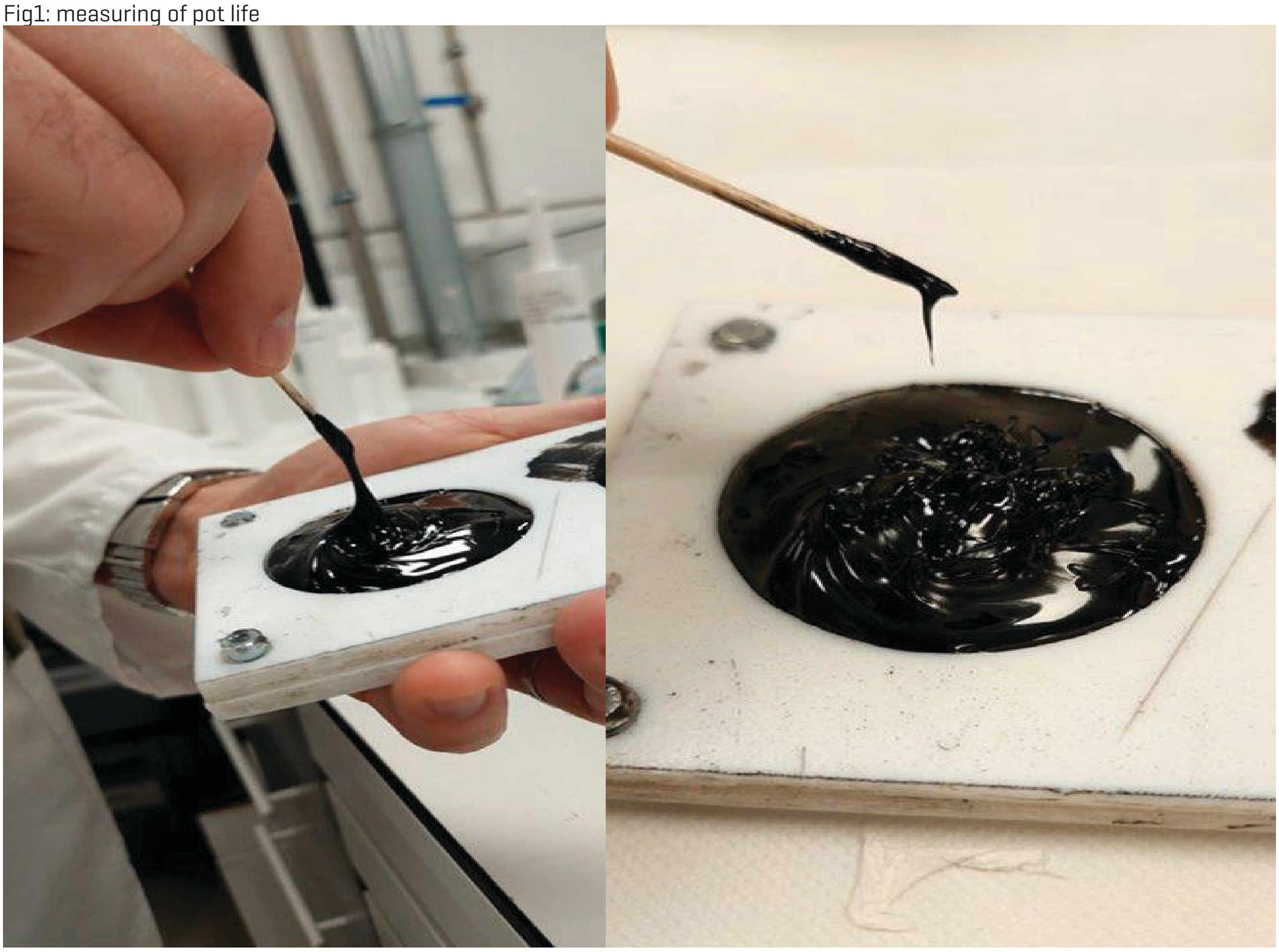
Pot life, Tack free time

1. Method

a. This internal procedure describes how to determine the setting time of 2K sealants

A and B component homogeneously mix in the appropriate weight ratio. The sealant is applied to the clean surface and the application time is recorded. Use a wooden stick to control the time when the mass starts to thicken or stops stringing.

Fig1: measuring of pot life



Material starts to thicken

Pot life is given in time (min).

b. This internal procedure describes how to determine the setting time of 1K sealants

In contrast to 2K sealants , 1K sealants cure with moisture from air. The processing time is measured by testing tack free time of the surface. Tack free time is given in unit: min.

2. Facts:

a. **Longer pot life reduces risk of static mixer overgrowing and increases processing time.**
a. **With higher temperature pot life is decreased.**
a. **Colder air cannot hold as much moisture as warm air. This has direct impact on curing dynamics of 1K sealants in winter time. Tack free time and curing dynamics are extended.**

TKK laboratory testing

Rheological properties

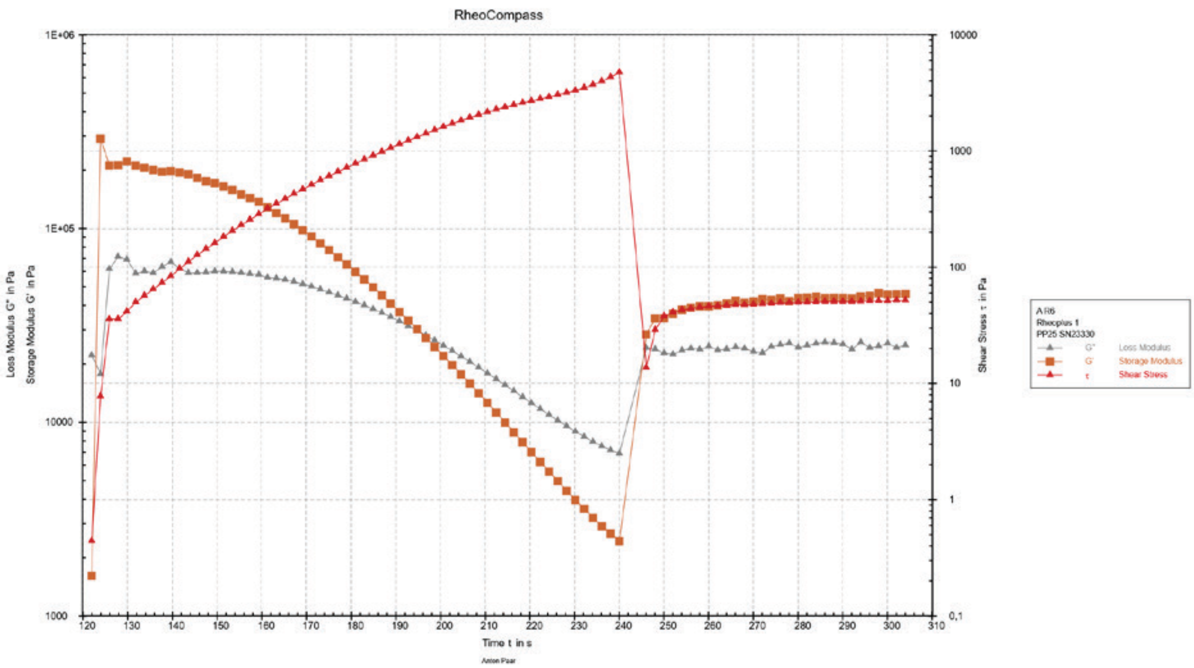
The evaluation of rheological properties of the sealant is based on standard DIN 54458

1. Method

During the test the deformation of the sealant is increased from 0,01 till 100% with determined oscilation frequency. In the beginning of the test the material will behave as an elastomeric solid, then a limit will be reached and the material will start to flow.

With the test we can determine linear viscoelastic range LVE- the thixotropy and flow point when the material starts to flow.

Fig1: Amplitude sweep graph



2. Facts:

a. **Linear viscoelastic range – Thixotropy is not directly related to viscosity. Even low viscous materials can have high thixotropy and Vice versa. High viscous materials can also have low thixotropy.**
a. **Be aware that thixotropy is also reduced as inner strength of sealant structure is affected.**
a. **If the sealant has low viscosity and thixotropy this can can have an impact on pumping the mass from the drums which is directly related to the mixing ratio when using 2K systems. So-called soft spots on the perimeter of IGU can appear.**

The evaluation of the viscosity

1. **Method**

With this method we determine the dynamic viscosity of the non-Newtonian liquids (pastes) using rotational mode at constant T=20°C

2. **Principle:**

If you place a paste between two parallel plates, the top plate pushes parallel to the bottom plate with a constant pressure of one pascal. If the top plate moves the same distance as the distance between the plates in one second, then the liquid between the plates has a dynamic viscosity unit of one pascal-second.

3. **Facts**

   a. The higher the viscosty is the thicker the material is and the greater the resistance to flow erg higher pressure is needed for dispensing.
   b. Viscosity of material can be reduced by heating in order to increase the temperature of the sealant. Temperature of the heating must not exceed +40°C

Fig1: Rheometer

Test in production

Thoroughness of mixing

Thoroughness of mixing is based on standard EN 1279-6 :2018 annex F

1. Method

The purpose of the test method is to evaluate thoroughness of mixing of the two parts of a sealant, usually referred to as base – A component and hardener-catalyst B component.

2. Preparation of sample

Two pieces of float glass (4 or 6 mm) of approximate 250 mm × 150 mm should be prepared to ensure that they are clean and free from smears, grease marks, finger prints or other contamination.

Approximately 10 g of mixed sealant, freshly taken from the continuous flow of the production should be placed in center of one piece of the glass with minimum entrapment of air. Place the second piece of glass onto the sealant to form a glass/sealant/glass sandwich and press the two glass pieces together until the remaining sealant thickness is approximately 1 mm

Inspect both sides of the sandwich, for signs of striations (marbling or streaks) which indicate poor mixing. The sealant should be evenly coloured on both sides.

Fig1: signs of striations

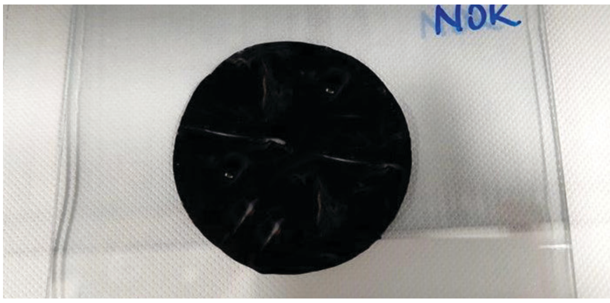
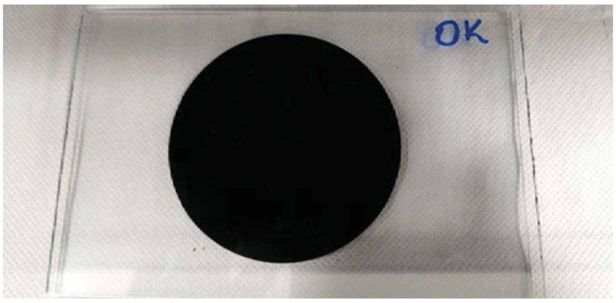


Fig2: evenly coloured



3. Facts:

The quality of mixing can be affected by the following factors.

a. **Clogged static mixer**
b. **Deformed static mixer**
c. **Irregular dimension of inner spirals**
d. **Insufficient number of spirals**
e. **Incorrect mixing ratio**
f. **Excessive difference in the viscosity of the A and B components**

Consequences of bad mixing:

a. **Poor adhesion**
b. **Poor curing dynamics**
c. **High gas and water vapour permeation**

Recommendation for Factory Quality Control insulating glass production

2024, August

1. General

This company instruction describes a testing methods for secondary insulating glass sealant to determine A and B component mixing quality and properties of mixture.

Mixing quality and properties of mixture of secondary insulating glass sealant are determined using several testing methods (pot life, Shore A hardness, adhesion to spacer and glass, surface tackiness, mixing quality).

2. Normative references

EN ISO 868:2003	Plastics and ebonite - Determination of indentation hardness by means of a durometer (Shore hardness)
EN 1279-4:2018	Glass in building - Insulating glass units - Part 4: Methods of test for the physical attributes of edge seals
EN 1279-6:2018	Glass in building - Insulating glass units - Part 6: Factory production control and periodic tests

3. Temperature influence

Sealant components A and B react with each other. Both components together build up the backbone of the resulting polymer. Keep in mind that the temperature significantly affects the curing dynamic and final properties of sealant. In general, the rate of chemical reaction doubles for every 10 °C rise in temperature. Consequently, with temperature decrease the pot life increases and the build-up of sealant hardness and adhesion slows down. During the hot or cold weather make sure that the build-up of the hardness and the adhesion is still acceptable for the production speed, and the pot life is still long enough to maintain the machinery in good condition. Temperature also influences the flow properties of the components and the mixed sealant. Drop of temperature rises the viscosity of the compounds and higher pumping capacity of the dispensing device is required.

Ensure the sealants components are conditioned at least 24 hours in application temperature before use. Note that due to a low thermal conductivity of sealant, the warm-up time can be quite long. For example, a drum that has cooled down to 10 °C needs about 7-8 days at temperature of 20 °C to become to a temperature of 15 °C. Reference application temperature range is from +20 °C to +25 °C. If influence of temperature to curing speed and adhesion build up is controlled, application temperature range can be increased to +15 °C to +30 °C.

4. Verification of raw materials

Provable information on the A and B components packaging:

Check if on the drums are appropriate product label; if supplied product is ordered one; if A and B components are from one product set.

On the each component drum is additional label with batch number and date of production. Shelf life of components is 6 months for PU and 8 months for PS from the date of manufacturing. Check if shelf life has not expired.

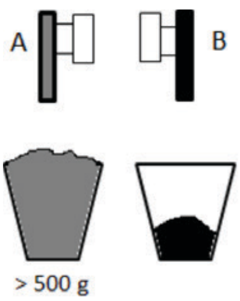
On a lid of the drum of A component is another addition label with mixing ratio of A and B components by volume.

5. Device settings, sample preparation and quality control of the mixture

Nr.	Test	Testing methods	References
1.	Temperature of A, B components in drum and temperature of mixture after mixing the components	Using the infrared thermometer	If the component temperature is below 15 °C, turn on the heating of plate
2.	Mixing ratio of A and B components	Weighing A and B components or calculation by measuring the movement of the pressing plate	Product certificate of analyses, device adjustments according to the manual instructions

Mixing ratio:

- The nominal dosing ratio of A and B components specified by the manufacturer in certificate of analyses and on the label;
- Determined mixing ratio shall not differ more than 10% compared to the nominal;
- If the determined mixing ratio differs from the manufacturer indicated, make device adjustments according to the manual instructions;
- The mixing ratio may be determined by one of the following ways:
- using for this purpose specially designed valves determine dosing ratio of A and B components (by weight):



1) adjust device according to the manufacturer defined A and B components nominal mixing ratio;

2) record the weight of the empty containers;

3) determine mass of each component by the equivalent number of full strokes at the same time (typically, one upstroke and one down stroke);

4) weigh the containers with components and respective take off tare;

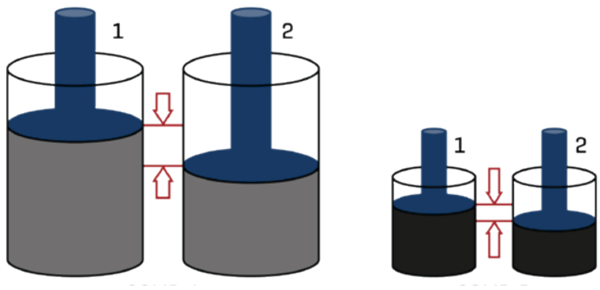
5) make 3 parallel measurements;

6) calculate mixing ratio:

Mixing ratio = 10 : X
X = 10 × B/A

(B – B component, gram; A – A component, gram)

Calculation of the mixing ratio by measuring the movement of the pressing plate in drums:



1) adjust device according to the manufacturer defined A and B components nominal mixing ratio;

2) take the measurements of the A and B component pressing plate in 1. position (distance between upper part of drum and pressing plate);

3) produce several IGU (at least 50 IGU or 10 litre of sealant);

4) take the measurements of the A and B component pressing plate in 2. position;

5) calculate mixing ratio of A and B components taking into account the coefficient 2,40 (due to different diameters of A and B component drums and due to mixing ratio of 10:1 (by volume). The proportion of the distances of both pressing plates from first to second measuring must be 2,40:1. For example, if the pressing plate of A component came down by 15,0 cm, but of B component came down by 6,25 cm, then in division of A/B you will get 2,40.

Nr.	Test	Testing methods	References
Produce "snake" (for manual dosing equipment) or mass quantity (for automatic dosing equipment) from mixture onto cardboard by making 2 upstrokes and 2 down strokes of the pump piston (see figure 1).			
3.	Contaminants in the mixture	Visual assessment	
4.	Evaluate the homogeneity of the mixture, uniformity of curing and compatibility of components after 24 hours from the moment when "snake" was made	Visual assessment. Determine the characteristics in one of the freely chosen "snake" section in the hardest and in the softest place. Cut through the section with a knife in the longitudinal direction	
5.	Determine Shore A hardness, surface tackiness of the hardest and softest place of each section after 24 hours from the moment when "snake" was made	Determination of Shore A hardness	EN ISO 868; EN 1279-6, annex E

Measurements of Shore A hardness:

- After 24 hours from the moment when "snake" was made determine Shore A hardness, surface tackiness of the hardest and softest place of each section. Record Shore A values as an interval (minimum - maximum value);

  Note. Softest and hardest places select with a finger tap on the established "snake".

- To ensure that changes of the Shore A values are not affected by the process-related parameters, parallel make the samples from manually mixed mass (taking into account nominal mixing ratio):
  - place the mixture without air bubbles in a mould with at least 50 mm diameter and 6 mm thickness;
  - flatten the surface of mass;
  - provide that the curing temperature is in range of +15 °C to +30 °C, after 24 hours perform the measurements;
  - press durometer perpendicular to the sample surface with load of about 10 N. The measurement must be carried out within 3 seconds from the moment when the gauge is touching the surface of the sample.

Figure 1. "Snake" onto cardboard

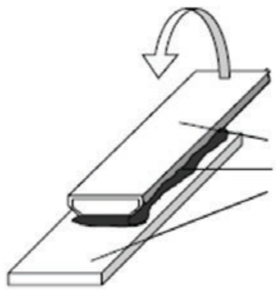
Nr.	Test	Testing methods	References
6.	Pot life	Method described below	

Pot life:

- From start section of the "snake" transfer small amount of mixture in the container;
- Start testing after 5 minutes from the sealant extrusion moment;
- Touch the surface of sealant with wooden stick. Then slowly move away stick from the mixture
- If the sealant sticks to wooden piece and stretches along it, then repeat the test every 2 minutes.
  Pot life is time interval from moment of sealant mixing until time when sealant no longer leave imprints on a clean wooden stick and does not stretch along it after touching.

Nr.	Test	Testing methods	References
7.	Adhesion spacer-sealant-glass	Express method	
8.	Failure mode after sealant curing at high temperature (accelerated method)	Accelerated method	EN 1279-6, Annex F

Adhesion to spacer and glass of spacer-sealant-glass sample:

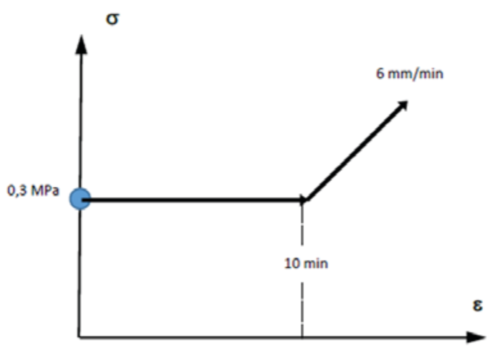


From section of "snake", which corresponds to one stroke, beginning, middle and end take 2 samples of mixture;

Failure mode is determined after 24 hours sealant curing at standard conditions (temperature + (23 ± 2) ° C)

Sealant has passed the test if the aluminum spacer detachment from the glass plate occurs along sealant (cohesive ≥ 90%).

Failure mode after sealant curing at high temperature (accelerated testing method):



To obtain final values samples are exposed for 28 days in standard conditions, it is, environment with temperature +(23 ± 2) °C and relative humidity (50 ± 5) % r.h.

- after curing fasten the sample in testing clamps. Load the sample in tensile in two consecutive modes:

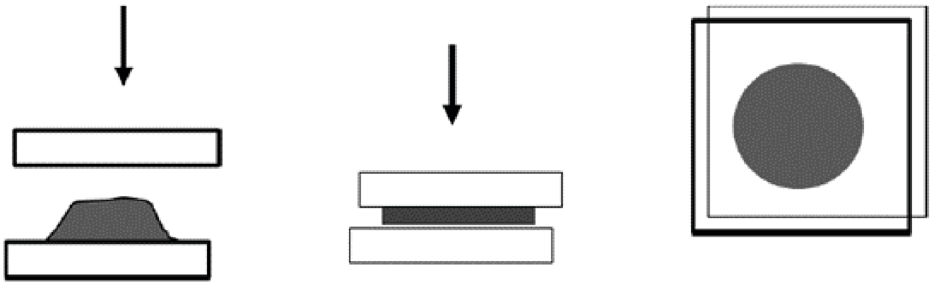
a) constant load mode: apply load 0,3 MPa (0,3 N/mm2) with speed 12 mm/min and keep it constant for 10 minutes;

b) increasing load mode: stretch the sample with speed 6 mm/min until failure of sample.

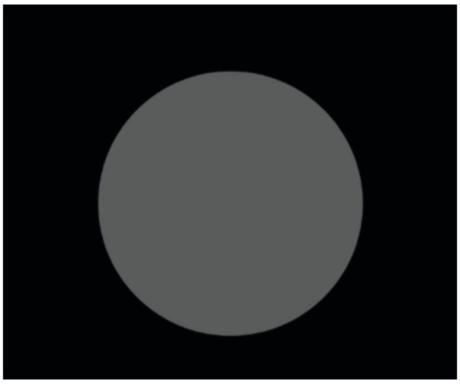
If spacer is broken during the test, the test result of this sample is ignored. If the sample does not break during the testing mode of constant load then the test result is stress at break,6B. If the sample breaks during the testing mode of constant load then the test result is 0.

Test	Testing	References	Test
Mixing quality, colour homogeneity of mixture and the presence of impurities	Visual assessment	EN 1279-6, Annex D	Mixing quality, colour homogeneity of mixture and the presence of impurities

Mixing quality:



- place approximately 10 g of mixed sealant in the center of one piece of glass substrate (approximate dimensions 250 × 150 mm) with minimum entrapment of air;
- surfaces of glass have to be clean and free from smears, grease marks, fingerprints or other contamination;
- place the second piece of glass onto sealant to form a glass-sealant-glass sample;
- press the two glass pieces together until the remaining sealant thickness is approximately 1 mm;
- inspect visually both sides of the sample for signs of striations (marbling or streaks) which indicate poor mixing.

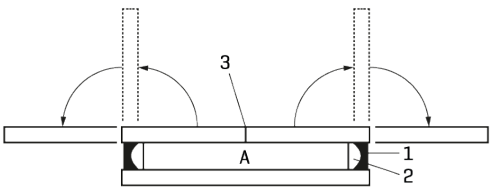


Homogenous mixture – good mixing quality

Noticeably white stripes – bad mixing quality

Nr.	Test	Testing methods	References
10.	Adhesion to glass (or coating)	Butterfly test	EN 1279-6, Annex F

Adhesion to glass:



- assemble a unit in accordance with Figure 7 using clean glass taken from production line, and press it on the production line;
- store the unit at a temperature of +23 °C or higher for 24 h;
- cut the glass in the middle (see figure 7 - cutting line) and force both plane segments to the positions B, using gloved hands or a suitable jig over a period of 10 s;

Key:
1 – sealant A – position A
2 – spacer B – position B
3 – cutting line

Test frequency of characteristics:

- result is positive, if the failure occurs along the sealant (cohesive ≥ 90 %). No adhesion failure of the sealant from the glass or the coating is allowed. Due to high stresses applied, failure of the sealant to the spacer does not constitute failure of the system.

6. Trouble shooting

Cause	Effect	Remedy
1. Mixing uniformity (marble effect, light stripes):		
	Slight shades in the mixture is still acceptable	Repeat testing after producing of another 20 to 30 IGU. If quality of mixture after 20-30 IG units is still unacceptable, please see the causes listed below
Overgrowing of static mixer	Bad mixing quality of A and B mixture	Clean the static mixer; Change the static mixer
Operation fault of reflux valve	Discontinuous flow of A and/or B component	Clean or change valve
Filter (pump) of B component blocked	Too little B component in the mixture	Clean or change filter
Diameter of the static mixer too small	B component flows along the gap between pipe and static mixer	Use static mixer with the right diameter; Use suitable pipes
Static mixer too short	Bad mixing quality of the mixture	Use longer static mixer

Cause	Effect	Remedy
2. Mixing ratio (one component is used before the other) (wrong and/or varying mixing ratio)		
Wrong set up of the device	Continuous dosing failure	Set up the device in the recommended mixing ratio (by volume, see product label)
Frequently purging with A component	High consumption of A component, high amount of remaining B component	Optimization of the production process (less breaks); Shorter breaks
Overgrowing of static mixer	Changed pressure ratio of the device; A or B component supplied more as normal	Clean the static mixer; Change the static mixer
Malfunction of a valve	Backflow of A or B component; Discontinuous flow of A and/or B component	Clean or change valve
Worn or leaky gaskets	Sealant is not supplied in sufficient quantity	Secure seals tightly and/or replace them

3. Curing (too slow)		
Low temperature	Slow curing (see product technical information)	Bring the IGU in warmer environment
Overgrowing of static mixer	A or B component supplied more as normal; Changed curing dynamic	Clean the static mixer; Change the static mixer
Wrong mixing ratio (too much B component)	Curing dynamics remains practically unchanged; Need more time to ensure required adhesive strength	Set up the device in the correct mixing ratio; Repair malfunction of the device
Wrong mixing ratio (too little B component)	Slower curing dynamic; No curing occur; Lower Shore A hardness units; Increase of surface stickiness, staining surface; etc.	Set up the device in the correct mixing ratio; Repair malfunction of the device

4. Hardness, Shore A (too high, too low)		
Wrong mixing ratio (too much B component)	Faster curing dynamic; Higher Shore A hardness units, for PU and lower Shore A for PS	Set up the device in the correct mixing ratio; Repair malfunction of the device
Short curing time (< 24h)	Low Shore A hardness	Allow the sample cure 24 hours
Low temperature	Slow curing	Store test sample at room temperature (23 ± 2) °C
Surface of the test sample uneven (dent)	Lower Shore A hardness	Perform measurements on smooth surface
Surface of the test sample uneven (hill, lump)	Higher Shore A hardness	Perform measurements on smooth surface
Testing pressure too high	Higher Shore A hardness	Ensure even test pressure of about 1 kg or 10 N
Test sample too thin	Higher Shore A hardness	Ensure even thickness of the sample (6 to 7 mm)
Test sample too thick	Lower Shore A hardness	Ensure even thickness of the sample (6 to 7 mm)

Cause	Effect	Remedy
5. Adhesion (too low, poor)		
Dirty, dusty surface of the substrates	Poor adhesion. Dust and grease work as barrier and can delay or stop occurrence of adhesion	Clean the surfaces. It is recommended to prepare several samples, which are tested after 24, 48 and 72 hours curing
Wrong mixing ratio (too much B component)	Bad adhesion or it does not exist	Set up the device in the correct mixing ratio; Repair malfunction of the device
Cold surface, "condensation"	Poor adhesion. On cold surfaces moisture condensates are forming, that form a barrier to adhesion buildup	Before sample producing, at least 24h store substrates and A, B components at room temperature
Low temperature	Poor adhesion. At low temperature the curing speed of the sealant and development of adhesion is slowed down	Store the samples at higher temperature or check the adhesion later. It is recommended to prepare several samples, which are tested after 24, 48 and 72 hours curing
Poor mixing quality	Poor adhesion. Insufficient mixing quality of mixture produces negative result of adhesion	Ensure the even and accurate mixing of components
Deviation for the nominal mixing ratio	Poor adhesion. Deviation of the mixing ratio must not differ more than ± 10 % from the nominal quantity.	Ensure correct mixing ratio of the components

6. Too runny sealant – high sealant temperature		
Drums with A and B component stored in hot environment	Sealant too runny	Ensure room or material cooling
Drums with A and B component stored in direct sun light	Sealant too runny	Do not store drums in direct sun light
High ambient temperature	Sealant too runny	Ensure room cooling
Heating of the plate set higher than 30 °C	Sealant too runny	Turn the heat down or turn off the heating of the plate
7. Device malfunction (pressure deviations, wrong dosing, deviations etc.) Always see the information given in manufacturer`s manual instruction. "Snake" test is useful inspection for a comprehensive fault diagnosis for manual devices. Extrude "snake" of sealant 1-2 m long onto cardboard and mark the switch points of the pump (change from upstroke to down stroke of the pump piston). After 60-90 minutes of curing check the hardness of the material by finger pressure. Record number of soft spots		
Dosing problem in each switch point (up and down stroke)	Same of soft spots as switch points	
Dosing fault on either the up or the down stroke	Only half of soft spots as switch points	
Problem at the start or the stop of extrusion	Only one soft spot	
Random fault	Random soft spots	

8. Hand mixing
Mixing by hands excludes effects of device, therefore the performance of the sealant and shelf life can be confirmed.
Prepare a mixture with defined nominal mixing ratio. Stir slowly about 3 minutes until homogenous mixture is achieved.
Prepare samples for hardness and adhesion tests (see previous described methods).

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