

Test report

Test report relating to a glass product according to European standard EN 1279-4; MVTR, gas permeation rate and tensile strength testing concerning the product marked as: PS998 / KU83, manufactured by: Nedex Chemie Deutschland GmbH

Report number 89211752-01
Date 22 May 2017
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Client Nedex Chemie Deutschland GmbH
Konrad Zuse Strasse 33
47445 Moers
Germany
Project number 89211752
Project name 17.A071 - EN1279-4
Number of pages 14



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1 Introduction

1.1 Purpose

The tests have been performed in order to determine the properties of a sealant according to European standard EN 1279-4 [1].

1.2 Description of the test specimen

General

Name of the manufacturer	Nedex Chemie Deutschland GmbH
Address of the manufacturer	Konrad Zuse Strasse 33 47445 Moers Germany
Production plant of the samples	see above
Line ID where the samples are made	-
Production date sealant	11.12.2016
Sampling date	-
The product was marked as	PS998 / KU83

Specific

Sample dimensions	
Dimensions of the H-samples	H-samples (28x) Sealant: 50x12x12mm Glass: 70x12x6mm (2x)
Production data of H-samples	before 2 march 2017
Dimensions of the permeation samples	Disc Ø150 mm, 2.0±1 mm (7x)
Production data permeation samples	-
Sealant material (name)	PS998 / KU83
Type	polysulfide based
Batch no. comp. A	1612110826
Batch no. comp. B	n.a.
Mix ratio (m/m or v/v)	n.a.
Colour	black
Glass Specification	
Type of glass	Clear float glass
Type of coating (if present)	n.a.

1.3 Sampling procedure

TÜV Rheinland B.V., acting as Notified Test Laboratory, has had no influence on the selection of the sample. All test specimen within the sample were test-worthy and were received on 2 March 2017.

1.4 Application

The request for testing was submitted by the assignor on 5 May 2017, order or reference number or name: -. Assignment Form number: 17.A071.

1.5 Method of testing

All applicable tests have been performed according to the European standard EN 1279-4 [1].

1.6 Period of testing

The tests took place in the period week 13 till week 21, 2017.

1.7 Put out to contract

No tests were performed at third parties.

1.8 Privacy statement

Due to privacy reasons, the names of involved personnel that executed the tests are not disclosed in the report. However, this information is available on internal work sheets, test forms etc. in the project file.

1.9 Remark concerning this ITT report

For any other manufacturer this initial type test (ITT) report is not automatically valid. The manufacturer for this ITT report is defined under 1.2.

Reference to test report for moisture penetration index according to EN 1279-2 [2]: not known.

1.10 Notifications, accreditations, designations

TÜV Rheinland Nederland B.V. has been notified by the Dutch Minister for Housing and the Central Government Sector as Notified Laboratory (number 1750) and Notified (Factory Production Control) Certification Body (number 0336) for the European Construction Products Regulation 305/2011 (EU).

TÜV Rheinland Nederland B.V. has been accredited by the Dutch Accreditation Council (RvA) as ISO 17025 Test Laboratory (nr. L 484) and ISO 17065 Certification Body (nr. C078).

TÜV Rheinland Nederland B.V. has been designated as Technical Service (Laboratory) by the Approval Authorities for Germany (KBA – E1) and the Netherlands (RDW – E4) for automotive safety glass (ECE R43, 92/22/EC, 2009/144/EC).

TÜV Rheinland Nederland B.V. has been recognised by the German Institute for building technics (DIBt) under number NL005 as test, control and certification body.

Remark

The reported tests were performed under ISO 17025 accreditation.

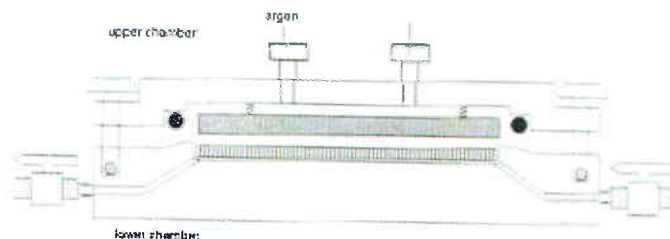
2 Test results

Moisture vapour transmission rate

Part 4 of the EN1279 describes the determination of the moisture vapour transmission rate (MVTR) of an adhesive used for sealing of IGU's. The applied method is based on the measurement of the gravimetric increase in weight of test samples during the exposure in a controlled environment. The conditions of the environment used for this determination are (23 ± 1) °C at a relative humidity [RH] of $93\pm 2\%$. The thickness of the sample material must be as close as possible to 2 mm and have a diameter of > 150 mm. A specimen with a diameter of 90 mm is cut out of the sheet. A metal dish is filled with a known amount of desiccant (CaCl_2 or molecular sieve with $\text{RH} < 5\%$) and covered by the specimen. The dish is closed by clamping a lid with an opening of 50 cm^2 on top of the sheet. At regular intervals the increase in weight of the dish is measured on an analytical balance with a resolution of 0.0001 g. The increase of weight [g] (with possible corrections for the increase in mass of a blank) and exposure time and exposed area are used for the calculation of the MVTR per day per m^2 . The results are expressed for a 2 mm thick specimen as: MVTR in $[\text{g}/(\text{m}^2 \cdot \text{day})]$, at 23 °C and a relative humidity of $> 85\%$.

Gas permeation rate

Part 4 of the EN 1279 [1] describes the argon or krypton gas permeation measurement. The argon and krypton transmission is measured by means of a gas cell and gas chromatography. The samples are placed between an upper and lower chamber of a gas cell. The upper chamber is flushed with argon or krypton and the lower chamber is flushed with nitrogen. After several hours of flushing the lower chamber is closed. This chamber is of a known volume. After several hours a gas sample is taken from the lower chamber and analysed by means of gas chromatography for the argon or the krypton percentage. From the percentage of argon or krypton in the nitrogen, the elapsed time, the volume of the lower chamber and the test area (100 cm^2) the argon or krypton transmission is calculated. Of each type of material three samples were measured at (23 ± 1) °C.



In the calculations an inverse relationship between permeation/transmission and thickness was assumed.

Physical properties of the sealants

This part covers evaluation of the edge seal strength. The requirement is that all edge seals shall have such sufficient adhesive and cohesive strength that during extension of the samples in an extensometer, failure outside the area OAB as given in Annex B of the EN1279-4 will occur. Breakage of the glass during testing will not constitute failure, providing that sufficient successful bonds are tested in order that the average result can be obtained. Besides this requirement the crossing point on the line AB is determined. A sealant manufacturer should realize that this value has a significant meaning according to the rules of the EN 1279-4 [1]. This significant meaning is that when a repeat test is conducted (on another batch, date or for other reasons) and there is more than 20% deviation recorded towards the original crossing point AB of the official reference ITT the sealant is to be considered as a 'different sealant'. Part 4 describes the physical attributes of the bond made by the primary sealant before and after shortened accelerated ageing cycles. This is not directly related to the durability of the bond but about the effects of these cycles on the changes of the sealants physical response. For each of the following shortened accelerated ageing cycles 7 samples are exposed.

Heat exposure

After initial cure and conditioning seven test specimens are aged in a closed oven at $(60 \pm 2) ^\circ\text{C}$ for (168 ± 5) hours.

Water immersion

After initial cure and conditioning seven test specimens are immersed in one to two litres distilled or deionised water for (168 ± 5) hours.

UV exposure

After initial cure and conditioning seven test specimens are exposed to UV irradiation for (96 ± 4) hours, exposed perpendicular to the glass at an intensity in the UVA range of $(40 \pm 5) \text{ W/m}^2$.

After the ageing, the samples undergo testing under tensile load. The test specimens are measured accurately for width, depth and height prior to being placed in an extensometer. The accuracy of the extensometer is equal to or less than 2%. The speed of separation is $(5 \pm 0.25) \text{ mm/min}$. The laboratory conditions are $(23 \pm 1) ^\circ\text{C}$ and $(50 \pm 5) \% \text{ R.H.}$

The breaking tension and tension at crossing the line AB were calculated from the mean of the contact areas between the sealant and the glass of the test specimens. The highest and lowest values were ignored so that the average values are calculated on the five remaining measured stress and strain values.

Measurement uncertainty data

Uncertainty on measured dimensions: $\pm 0.05 \text{ mm}$

Tensile test

$\sigma_{av} : \pm 0.01 \text{ MPa}$

$\epsilon_{av} : \pm 0.5 \% \text{ (absolute)}$

MVTR: $\pm 10\%$ with a resolution of $0.05 \text{ [g/(m}^2 \cdot \text{day)]}$

Gas permeation: $\pm 10 \%$ with a resolution of $0.0005 \text{ [g/(m}^2 \cdot \text{h)]}$

Test results after performing all applicable tests according to European standard EN 1279-4 [1].

Requirements and end result

Required	Value of the test	Pass / fail
4.1 Edge seal strength		
"All edge seals shall have sufficient adhesive and cohesive strength to allow the joints as specified to be extended such that any failure occurs outside the area OAB of figure 1."	All ruptures outside area OAB	pass

Detailed test results

Moisture vapour transmission rate on sheet (23°C, > 85% R.H. across the sheet)

Test specimen	avr. Thickness [mm]	Surface [cm ²]	MVTR (2 mm sheet) g/(m ² .24h)
1	2.3	50	12.6
2	2.1	50	12.7
3	2.1	50	12.2
		Average:	12.5

Argon permeation rate measurement on sheet (23°C)

Test specimen	avr. specimen thickness [mm]	Surface [cm ²]	Argon GPR (2 mm sheet)	
			g/(m ² .h)	g/(m ² .24h)
1	2.3	100	0.014	0.34
2	2.4	100	0.019	0.45
3	2.2	100	0.020	0.48
		Average:	0.017 ± 0.003	0.42 ± 0.07

Physical properties of the sealant

In total 28 H-samples were delivered. These samples were divided in four groups of samples. One group was for initial values and the other three groups were used for ageing under water, heat and UV environments. The following table shows the values at AB line crossing. The results are as follows:

Seal strength test	At intersection with line AB		Type of failure observed (if any) c = cohesive, a = adhesive				
	Average stress σ_{av} [MPa]	Average extension ϵ_{av} [%]	1	2	3	4	5
initial	0.343	15.7	c	c	c	c	c
after H ₂ O immersion	0.342	15.8	c	c	c	c	c
after heating at 60°C	0.352	14.8	c	c	c	c	c
after UV radiation	0.346	15.4	c	c	c	c	c
	average without min/max values						

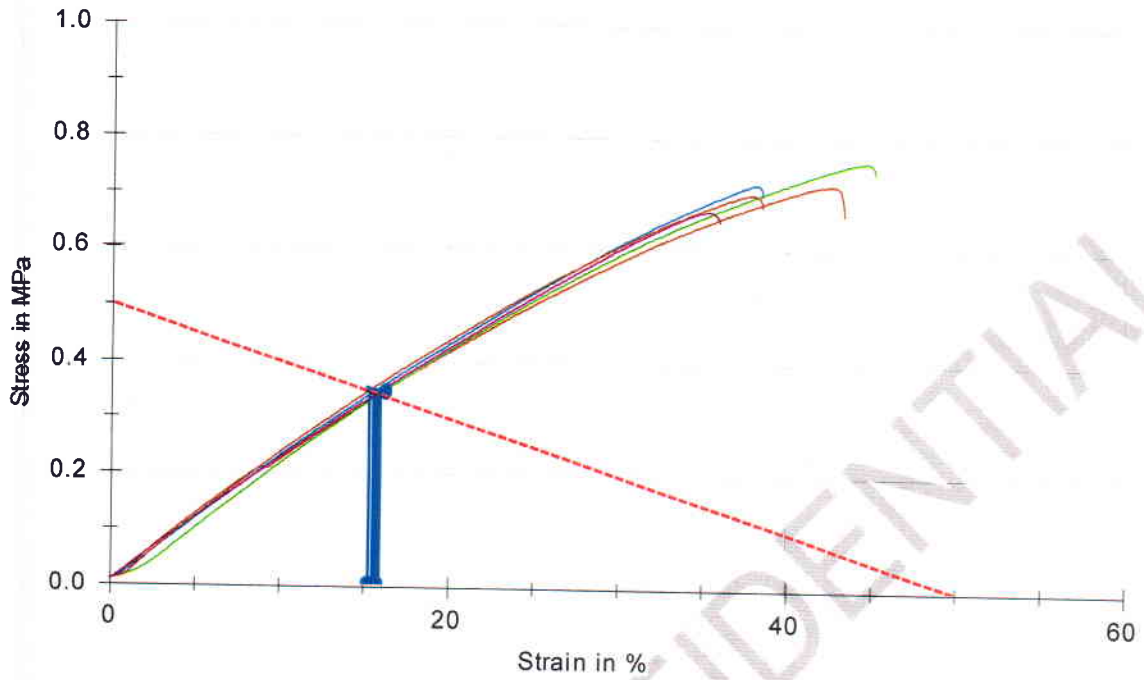


Figure 1: Stress/strain curves, initial

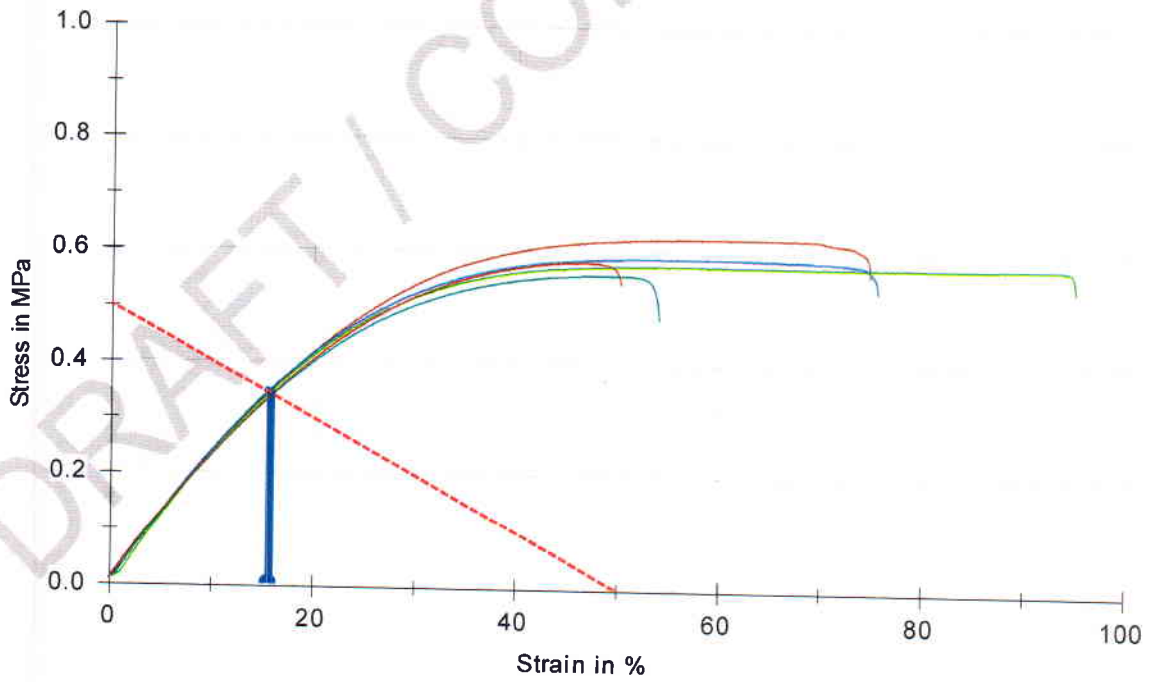


Figure 2: Stress/strain curves, after immersion in H₂O for (168 ± 5) hours

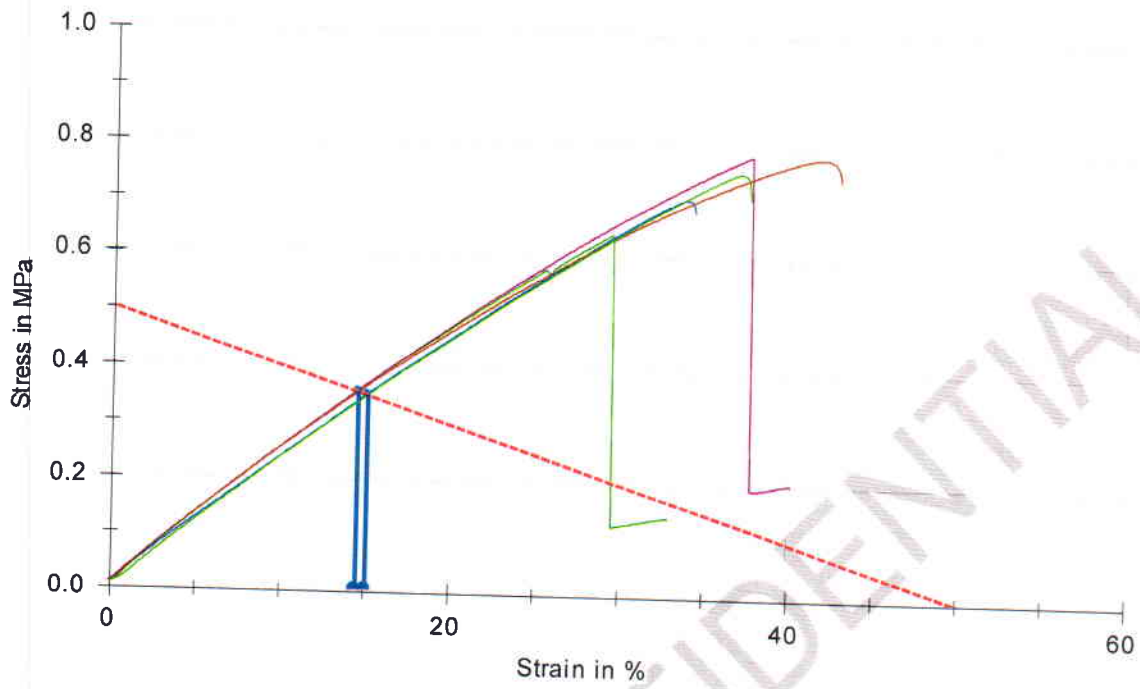


Figure 3: Stress/strain curves, after 60°C exposure for (168 ± 5) hours

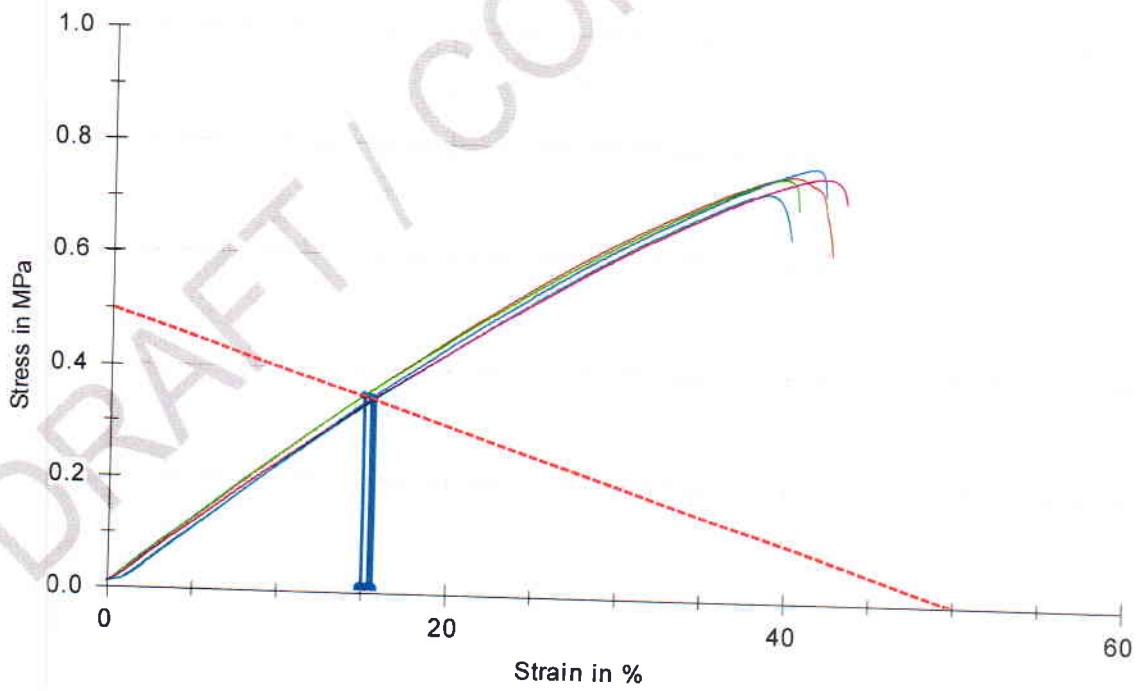


Figure 4: Stress/strain curves, after UV exposure for (96 ± 4) hours

3 Conclusion

The edge seal, marked by the client or manufacturer as: PS998 / KU83, manufactured by: Nedex Chemie Deutschland GmbH, meets the applicable requirements as stated in the European standard EN 1279-4 [1].

The test results exclusively relate to the tested objects.

Remark 1

When and if changes are made in production method and/or equipment, assessment according to this standard shall be reconsidered and re-tests shall be performed when the changes can lead to different specifications of the sealant. The decision and responsibility lies at the manufacturer.


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4 References

- 1 European standard EN 1279-4:2002 (E),
Glass in building – Insulating glass units – Part 4: Methods of test for the physical attributes of edge seals,
European Committee for Standardization, March 2002.
- 2 European standard EN 1279-2:2002 (E),
Glass in building – Insulating glass units – Part 2: Long term test method and requirements for moisture penetration,
European Committee for Standardization, November 2002.




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5 Signatures

Author Mr. M.A.A.M. Schets, B.Sc.	Signature 
Specialist	
Peer review Mr. R. Brandhorst	Signature
Specialist	
Approved by Mrs. C.C.M. van Houten	Signature
Manager operations	

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Appendix A, Summary of test results

TÜV Rheinland Nederland B.V. P.O. Box 2220, 6802 CE Arnhem The Netherlands Lab.no. 1750		 TÜVRheinland [®] Precisely Right.	
Summary of report n°: 89211752-01		Date: 22 May 2017	
Insulating glass units – Seal properties results according to EN 1279-4			
For details is referred to the full test report			
Company:	Name:	Nedex Chemie Deutschland GmbH	
	Address:	Konrad Zuse Strasse 33 47445 Moers Germany	
Sealant manufacturer:	Name:	Nedex Chemie Deutschland GmbH	
	Address:	Konrad Zuse Strasse 33 47445 Moers Germany	
Sealant specification:	PS998 / KU83		
Sealant in IGU positively tested according to EN 1279-2, report:	not known		
Glass specification when not float glass is used:	n.a.		
Seal strength test	At intersection with line AB (EN 1279-4, figure 1)		General type of failure observed
Adhesion:	Average Stress σ_{av}	Average extension ϵ_{av}	
	[Mpa]	[%]	C = cohesive, A = Adhesive
Initial cure	0.343	15.7	C
After water immersion	0.342	15.8	C
After heating 60°C	0.352	14.8	C
After UV radiation	0.346	15.4	C
Moisture vapour transmission rate:	Gas permeation rate:		
Film thickness, avg [mm]:	2.0	Film thickness, avg [mm]:	2.0
ΔP_{H_2O} [%]:	> 85	Surface (shape: circular) [cm ²]:	100
Test temperature: [°C]:	23 ± 1	Test temperature: [°C]:	23 ± 1
MVTR [grams H ₂ O/(m ² .24h)]:	12.5	Permeation rate [grams Argon/(m ² .h)]:	0.017
Overall comments:	-		
Conclusion of the seal strength test: Sealant conforms to the test criteria:	YES		
			
Signature: M.A.A.M. Schets, B.Sc. Specialist		Signature: Mrs.C.C.M. van Houten Manager operations	

This Summary is not a certificate.

Appendix B, Pictures of the test specimen



H-samples as received (left) and after tensile test (right) with typical failure type (cohesive)

(This is the end of this report).

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