
Group standard**TL 52223**

Issue 2019-02

Class. No.: 55125

Descriptors: TPE profile, adhesive bonding on both sides, adhesive tape, elastomer profile, heat-activated on one side

Adhesive Tape, Adhesive Bonding on Both Sides or Heat-Activated on One Side for Thermoplastic Elastomers and Elastomer Profile

6 types: A, B, C, D, E, F

Previous issues

TL 52223: 1981-05, 1989-09, 1991-04, 1993-02, 2008-12

Changes

The following changes have been made to TL 52223: 2008-12:

- Standard title changed
- Preface removed
- Section 1 "Scope" revised
- Section 3.1 "Basic requirements" amended
- Section 3.2.2 "Storage life": requirement changed
- Section 3.3 "Notes on the selection of adhesive tapes" amended
- Section 3.5 "Types" revised
- "Structure and composition" section deleted
- Section 3.6 "Determining the measured values": duration for acclimatization changed
- Table 1 revised and requirements changed
- Table 2: requirement for tensile lap shear strength after aging in transit coating remover deleted
- Section 5 "Notes on testing" updated

Always use the latest version of this standard.

This electronically generated standard is authentic and valid without signature. A comma is used as the decimal sign. The English translation is believed to be accurate. In case of discrepancies, the German version controls.

Page 1 of 8

Technical responsibility		The Standards department	
GQL-P/1	Isabel Toral	Tel.: +49 5361 9 963174	
GQL-P/1	Eckart Herrmann	Tel.: +49 5361 9 26163	
GQL-P	Denis Eschwey	K-ILI/5 Stefanie Peyer	K-ILI
		Tel.: +49 5361 9 41184	Uwe Wiesner

All rights reserved. No part of this document may be provided to third parties or reproduced without the prior consent of one of the Volkswagen Group's Standards departments.

1 Scope

This Technical Supply Specification (TL) defines the material requirements for adhesive tapes used to mount elastomer profiles, such as EPDM or CR, or optionally also TPE, onto painted body surfaces and on add-on parts.

In addition, this standard can also be used for comparable applications (soft component attached using adhesive tape) if no separate supply specification exists for the application in question.

Example: water-draining seal, EPDM profile for the top edge of the windshield, seal for panoramic sunroof aperture, air seal for panoramic sunroof frame, outer door seal, etc.

2 Designation

Example for a film without substrate made of adhesive compound:

Adhesive tape as per TL 52223-A

3 Requirements

3.1 Basic requirements

Approval of first supply and changes as per Volkswagen standard [VW 01155](#).

Avoidance of hazardous substances as per [VW 91101](#).

The required numerical values apply to each individual measurement.

At least 3 m or the corresponding number of pieces of the self-adhesive profile or body panel cut parts are required.

The standard defines and describes the adhesion and component functionality of bonded partial areas examined on the component (bonding is virtually strain-free). It does not cover the scopes of the manufacturing process of the supplier purchase part, the body-in-white, the paint quality, and the process planning. These scopes must be verified separately by the purchase part supplier (verification of process and functional capability of bonds used to attach components to the vehicle body).

3.2 Delivery form

The adhesive tapes are delivered attached to the profiles.

3.2.1 After-sales service parts

The side of the adhesive tape to be bonded to the body panel is covered by a protective PE film with a thickness $\geq 0,05$ mm.

The profiles with a pre-applied adhesive tape are delivered in hermetically sealed bags made of PE film with a thickness $\geq 0,1$ mm.

3.2.2 Storage life

At least 1 year in a standard atmosphere [VW 50554](#) – 23/50-2 and no more than 2 years after manufacture. Direct solar radiation and a temperature above 60° C must be avoided. The PE protective film must be easy to remove before installation without any residue.

3.3 Notes on the selection of adhesive tapes

Apart from the characteristics of the adhesive system, the properties of an adhesive bond are also determined by the material composition (e.g. plasticizer content), geometry, mass, and the mechanical behavior (e.g. elasticity) of the profile.

If the profiles are bonded profiles with increased mechanical requirements, higher force values may need to be defined in the drawing or in the performance specification for the adhesive bond.

Another highly significant influencing factor is the physical-chemical surface condition of the various bonding substrates (paint systems). The surface energy must be taken into account when selecting the adhesive tape.

Rapid bond formation may be necessary. The necessity for this depends on the planned dwell time between attachment of the profile and load application during installation. In this case, an adhesive tape with rapid bond formation must be used, and the available thicknesses of these adhesive tape systems must be taken into consideration when designing the profile.

3.4 Adhesive tape dimensions

If the adhesive tape selection is limited to one material type, attention must be paid to ensuring that the thickness and width is suitable for meeting the requirements (adhesive tape material type and seal base, geometry).

For bonds that are to be loaded, the appropriate Development department must define the maximum load and the minimum strength requirements.

3.4.1 Width and thickness

As per drawing

3.5 Types

- TL 52223-A Film without substrate, made of adhesive compound
- TL 52223-B Adhesive tape made of PE-foam substrate, coated on both sides with adhesive such as modified acrylate or pure acrylate
- TL 52223-C Adhesive tape made of PE-foam substrate, coated on one side with adhesive such as D 1 and heat-activatable hot-melt adhesive on the profile side
- TL 52223-D Adhesive tape made of closed-cell polyacrylic acid ester foam
- TL 52223-E Adhesive tape made of closed-cell polyacrylic acid ester foam core substrate, coated on both sides with adhesive such as modified acrylate or pure acrylate
- TL 52223-F Adhesive tape made of closed-cell polyacrylic acid ester foam core substrate, coated on one side with adhesive such as E 2 and heat-activatable hot-melt adhesive facing the profile side

3.6 Determining the measured values

Unless otherwise specified, measurements are taken after 24 h of acclimatization in a standard atmosphere as per [VW 50554 – 23/50-2](#).

4 Requirements for the properties

4.1 Adhesive tape

Requirements for tensile strength and elongation at tear can be found in the manufacturer data sheets. A numerical simulation must be performed on statically and dynamically loaded adhesive bonds to determine whether the material properties of the foam core meet the requirements. The minimum values presented in the following sections are based on known bonding systems. Foam fracture in the tape signifies a sufficiently good adhesion of the overall system and results in acceptance of the bonding system during the test. If the values achieved are below the minimum values, an estimate must be made on whether the values will withstand the loads that will occur.

The degree of testing precision must be matched to the respective application. The corresponding agings in media only need to be performed when actual contact with these media is possible during driving operation or vehicle manufacturing. By virtue of its location, a roof edge seal bonded onto the windshield comes into contact with window washer fluid.

The ball drop test as per Test Specification PV 3905 does not need to be performed for profiles bonded onto glass.

When creating the bond, it must be ensured that the surfaces have been cleaned sufficiently and that the optimal pressure for the selected adhesive tape is applied. The joining surface geometries must enable suitable and sufficient contact pressure.

4.2 Connection between painted panel or add-on part and profile

4.2.1 Peeling stress

See table 1.

Table 1

No.	Property	Unit	Requirement	
			Profile, static load	Profile, dynamic load
1	Floating roller peel test of all types, see section 5.4			
1.1	As-received condition			
1.1.1	After 15 min	N/cm	-	$P_p \geq 20$
1.1.2	After 24 h	N/cm	$P_p \geq 20$	$P_p \geq 35$
1.2	After heat aging See section 5.1.	N/cm	$P_p \geq 15$	$P_p \geq 30$
1.3	After heat and humidity aging See section 5.2	N/cm	$P_p \geq 12$	$P_p \geq 30$
1.4	After low-temperature aging See section 5.3.	N/cm	$P_p \geq 15$	$P_p \geq 30$

Or material fracture in profile/adhesive tape

4.2.2 Surface load

See table 2 and table 3.

Table 2

No.	Properties	Unit	Requirement	
			TL 52223-A	TL 52223-B to -F
1	Tensile lap shear strength, see section 5.5 and section 5.6			
1.1	As-received condition	N/cm ²	≥ 10	≥ 20
1.2	After heat aging See section 5.1.	N/cm ²	≥ 10	≥ 20
1.3	After heat and humidity aging See section 5.2	N/cm ²	≥ 8	≥ 15
1.4	After low-temperature aging See section 5.3.	N/cm ²	≥ 8	≥ 15
1.5	After aging in window washer fluid See section 5.10	N/cm ²	≥ 8	≥ 15
1.6	After aging in test fuel See section 5.11	N/cm ²	≥ 8	≥ 15

Or material fracture in profile/adhesive tape

Table 3

No.	Properties	Unit	Requirement	
1	Tensile lap shear strength of the bond over time as per DIN EN 15336 and section 5.7			
1.1	At room temperature VW 50554 – 2	N/cm ²	≥ 5	Or material fracture in profile/adhesive tape
1.2	At elevated temperature of +70 °C	N/cm ²	≥ 2	
2	Tensile strength perpendicular to face, see section 5.8			
2.1	As-received condition	N/cm ²	≥ 30	Or material fracture in profile/adhesive tape
2.2	After heat aging See section 5.1.	N/cm ²	≥ 30	
2.3	After low-temperature aging See section 5.3.	N/cm ²	≥ 20	
3	Low-temperature behavior, see section 5.9			
3.1	Ball drop test as per PV 3905		No destruction of or damage to the painted panel/profile bond	

5 Notes on testing

5.1 Heat aging

Aging for 240 h at 90 °C.

The measurement is taken after at least 24 h of acclimatization in a standard atmosphere as per VW 50554 – 23/50-2.

5.2 Heat and humidity aging

Aging for 240 h at 70 °C and 100⁺⁰₋₆% relative humidity.

After aging is complete, the specimen is dried at 70 °C in a drying oven with fresh air feed, for a duration of 8 h.

The measurement is taken after at least 24 h of acclimatization in a standard atmosphere as per VW 50554 – 23/50-2.

5.3 Low-temperature aging

Aging for 48 h at -30 °C.

The measurement is taken after at least 24 h of acclimatization in a standard atmosphere as per VW 50554 – 23/50-2.

Test is only required if exposure is theoretically possible. For example, test is meaningless on glazing.

5.4 Floating roller peel test

Determination of the relative peel resistance P_p in a floating roller peeling fixture as per DIN EN 1464; except traverse speed is 50 mm/min.

Testing is performed with a tensile test device conforming to at least class 1 requirements as per DIN EN ISO 7500-1 Supplement 1.

The original structure must be used for determining the relative peel resistance. If P_p cannot be determined on the original substrate using a tensile test device as described above, a manual measuring instrument may be used as an alternative. Any profile material hindering the test process must be removed beforehand.

The relative peel resistance must be determined from the peel test diagram. It corresponds to the average resistance during a continuous peeling-off action. An area of the peel test diagram from 30% to 90% of the diagram length must be used for the evaluation.

Number of specimens: 5

5.5 Bonding behavior

Either the tensile lap shear test or the test of tensile strength perpendicular to the face is used as the test method, depending on the design of the profile. The drawing note contains the necessary information (e.g.: bond as per TL 52223, test method: traction adhesive strength test).

Specimen sections of 70 mm in length are bonded onto the painted test sheets (dimension 70 mm × 30 mm).

Any profile material hindering the test process must be removed beforehand.

The painted test sheets may only be used once.

If required, all paint systems (e.g. solid paint, 1-component metallic clear coat, 2-component PUR clear coat) must be included in the examinations.

The bonding surface area in the overlap area between the painted panel/add-on part must be as close to 3 cm² as possible.

Characteristic data of the bonding process:

- The painted panel and profile are conditioned at 40° C in a forced-air oven for 15 min.
- The parts to be bonded are joined with a contact pressure of 1,25 N/cm² for 15 min.
- Conditioning of the specimen at 50 °C in forced-air oven for 30 min. After acclimatization at room temperature [VW 50554 – 2](#) for 1 h, the specimen is ready for testing.

5.6 Tensile lap shear strength

Determination of tensile lap shear strength as per [DIN EN 1465](#), traverse speed 50 mm/min. During the test of resistance to various media, the relevance of the test must be determined based on the conditions at the point of use (see table 2, consec. no. 1.5 and consecutive no. 1.6).

Testing is performed using a tensile test device conforming to at least class 1 requirements as per [DIN EN ISO 7500-1](#).

The specimen is kept upright in the clamping fixtures of the tensile test device using suitable mounts.

Number of specimens: 5

5.7 Tensile lap shear strength of the bond over time

Determination of the tensile lap shear strength of the bond over time as per [DIN EN 15336](#), test duration ≥ 30 min. Before the test at elevated temperature of 70° C, the specimen is conditioned for 30 min.

Number of specimens: 5

5.8 Tensile strength perpendicular to face

The tensile strength perpendicular to the face is determined with a tensile test device conforming to at least class 1 requirements as per [DIN EN ISO 7500-1](#).

Traverse speed: 50 mm/min.

The painted test sheet is held horizontally by means of a suitable mount in the upper fixture of the tensile test device, and the profile is clamped in the lower fixture in its full length.

Number of specimens: 5

5.9 Low-temperature behavior

Testing of the low-temperature behavior as per [PV 3905](#); ball drop height: 23 cm.

Preparation of the specimens as per section 5.6, yet flush bonding of the painted panel/profile sections of 70 mm each.

Before the test, the specimens are conditioned for 24 h at -30 °C.

5.10 Aging in window washer fluid

Testing as per PV 2037; however, aging duration of 1 h.

5.11 Aging in test fuel

Aging in FAM test fluid as per DIN 51604-1 at 23_{-0}^{+2} °C; duration of 5 min.

The test is carried out 30 min after the specimen is removed from the medium. Only if required (contact possible during operation)

6 Applicable documents

The following documents cited are necessary to the application of this document:

Some of the cited documents are translations from the German original. The translations of German terms in such documents may differ from those used in this standard, resulting in terminological inconsistency.

Standards whose titles are given in German may be available only in German. Editions in other languages may be available from the institution issuing the standard.

PV 2037	Kunststoffteile, Verklebungen: Metall/Nichtmetall; Konservierungs- und Reinigungsmittel-Beständigkeit
PV 3905	Organic Materials; Ball Drop Test
VW 01155	Vehicle Parts; Approval of First Supply and Changes
VW 50554	Standard Atmospheres and Room Temperatures; Requirements on Standard Atmospheres
VW 91101	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Avoidance of Hazardous Substances
DIN 51604-1	FAM testing fluid for polymer materials; Composition and requirements
DIN EN 1464	Adhesives - Determination of peel resistance of adhesive bonds - Floating roller method
DIN EN 1465	Adhesives - Determination of tensile lap-shear strength of bonded assemblies
DIN EN 15336	Adhesives - Determination of the time to rupture of bonded joints under static load
DIN EN ISO 7500-1	Metallic materials - Calibration and verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Calibration and verification of the force-measuring system
DIN EN ISO 7500-1 Supplement 1	Metallische Werkstoffe - Prüfung von Prüfmaschinen für statische einachsige Beanspruchung - Teil 1: Zug- und Druckprüfmaschinen; Prüfung und Kalibrierung der Kraftmeßeinrichtung; Allgemeines zu Anforderungen und zur Prüfung und Kalibrierung von Zug-, Druck- und Biegeprüfmaschinen