VOLKSWAGEN

AKTIENGESELLSCHAFT

Group standard **TL 52311**

Issue 2021-08

Class. No.: 55121

Descriptors: A-pillar, ASA, B-pillar, C-pillar, acrylic-styrene-acrylonitrile, bumper grille, emblem, front fog lamp bezel, handle strip, mirror upper housing shell, radiator grille

ASA for Unpainted Parts

Materials Requirements

Previous issues

TL 52311: 1987-06, 2001-05, 2006-09, 2013-07, 2021-05

Changes

The following changes have been made to TL 52311: 2021-05:

a) Section 4.9 "Impact strength (dry conditioned)": Test corrected (DIN EN ISO 179-1/1fU instead of DIN EN ISO 179-1/1eU

The following changes have been made to TL 52311: 2013-07:

a) Title of standard changed

b) Standard completely revised

Contents

1 Scope

This Technical Supply Standard (TL) defines the materials requirements for unpainted finished parts with grained and high-gloss surfaces made of acrylic-styrene-acrylonitrile (ASA) (e.g., radiator grilles, bumper grilles, mirror upper housing shells, emblems, handle strips, and A-, B-, and C-pillars).

The area of application is parts with visible surfaces made of plastic.

2 Designation

Designation examples for the drawing text:

ASA, grained as per TL 52311

or

ASA, high-gloss as per TL 52311

3 Requirements

3.1 General requirements

Approval of first supply and changes as per Volkswagen Standard VW 01155.

Granular material as per VW 50026.

Resistance to open-air weathering as per VW 50185.

Materials sample inspection as per VW 52000

Material conformity as per VW 91101

Thermal stability and functional capability in the temperature range of -30 °C to 90 °C

3.2 Use of materials

The technological properties of the materials used for the parts must ensure the function and safety of the vehicle over the entire service life. Modifying agents for heat and UV stabilization must be used in sufficient quantity depending on the type and demands of the application if they are not already contained in the final compound.

In the case of parts made of composite materials (metal/plastic, adhesive bonds, hard/soft combination), compatibility of the materials must be ensured. If necessary, the materials must be matched to each other by means of pretreatments (e.g., bonding agents).

If the material for the finished part is changed during development or during ongoing series production, this change must be presented and examined again in all cases.

Table 1 (starting with no. 2) describes the materials requirements for the part.

Table 1 only refers to the basic material composition (ASA in this case) and not to defined commercial types. The requirements in the target specifications are decisive. They alone are used as the basis for the material release of the commercial types (in agreement with Testing).

3.2.1 Addition of regrind/recycled material (production waste)

Classified as per VW 50026.

Using recyclates from granular material class 4 (GK4) is currently not permitted. Fluctuations in the material of the recycled goods can negatively affect the visual and functional properties, which must be avoided. The varying material compositions can cause changes in the shrinkage of the material.

Material of GK3 is permissible if there are no changing material flows and the appropriate quantity is available for the project in question.

The addition of production waste up to 10% is permissible, but the same trade quality must be used. The addition of different material qualities is prohibited, even if the material compositions are identical. This is to rule out, for example, the chance of different stabilizer packages from different raw material manufacturers interacting with each other. In addition, only production waste that has been processed on the same production equipment may be used.

Exception: If multiple molds are used for the finished parts (e.g., left/right front fog lamp bezels), then the production waste from all of these molds may be used.

3.3 Marking as per VDA 260

DIN EN ISO 1043-1, DIN EN ISO 1043-2, and DIN EN ISO 11469 apply as the basis for marking. The marking must comply with these standards. The marking for ASA is:

> ASA <

3.4 Production and processing notes

The parts are injection-molded.

The parts must be processed in a low-stress manner in order to avoid stress cracks and/or deformations under the influence of temperature changes and substances.

If two-component injection molding is used, it must be ensured that both the visible surface and the substrate have the same or similar expansion coefficients to avoid bimetallic effects.

The sprue must be designed in such a way that weld lines are avoided.

Striations must be eliminated by adjusting the mold and compound temperature and the injection pressures if the striations are in the visible area.

Otherwise, the recommendations of the respective raw material manufacturer must be followed.

Moreover, a suitable tool steel is required for high-gloss surfaces.

3.5 Properties

The surface and interior of the parts must be free of production-related imperfections such as flow lines, cracks, and the like. Small voids are permissible only if they do not negatively affect the component's function. This must be ensured in the scope of testing. Voids must be prevented especially in attachment areas, because they produce a direct risk of fracture (e.g., in the area of threaded connections and/or clips). Computed tomography (CT), for example, can be used to inspect the microstructure.

The definition of voids (as per VW 50093) comes into effect only if abnormalities appear in the testing (crack formations, fractures) and void clusters are verified by subsequent cross sections or CT examinations. For the critical areas, limits on porosity are then defined in the part drawing.

Sink marks at the base of ribs and stiffenings are permissible only if they do not adversely affect the part's function or appearance.

3.6 Conditioning

Since ASA is sensitive to humidity, the mechanical and thermal properties may fluctuate, depending on whether the specimens were conditioned in dry or humid conditions. Therefore, the conditioning is specified in the individual tests.

3.7 Evaluation of the measurement results

The required numerical values apply to each individual measurement. Average values that achieve the minimum requirements of the TL will not be accepted if not every individual value meets the minimum requirements.

3.8 Part-specific materials requirements

Part-specific materials requirements are shown in table 1.

If materials from the list of released materials in appendix B are used, then only a reduced test scope needs to be verified. This is identified in the "No." column of table 1 with the footnote [c)].

Table 1

No.	Property	Unit	Requirement
1	Material quality		
1.1	Base material		ASA; pigmented, grained or high-gloss, stabilized against heat aging and UV radiation
2	Requirements for the properties		
2.1	Material Fourier-transform infrared spectroscopy (FTIR) analysis, see section 4.2		ASA
2.2	Low-temperature behavior with ball drop test[a)] as per Test Specification PV 3989 and section 4.3		No fracture, no cracking
2.3	Resistance to chemicals, see section 4.4		

Table 1 (continued)

No.	Property	Unit	Requirement
2.3.1	Isopropanol Testing as per DIN EN ISO 2812-4, method A, 10 min at room temperature VW 50554 – 2		1. 1 h at room temperature VW 50554 – 2: No visible changes, if changes occur, carry out step 2 2. 2 h at 60 °C reflow aging; No visible changes permitted, however, for small changes that are not relevant to the customer, consultation may be held with the purchaser.
2.3.2	5% sodium hydroxide solution (mass fraction) Testing as per DIN EN ISO 2812-4, method A, 1 h at room temperature VW 50554 – 2		
2.3.3	Water (quality grade 3 as per DIN ISO 3696) Testing as per DIN EN ISO 2812-4, method A, 1 h at 80 °C		
2.3.4	Artificial bird droppings[b)] Testing as per DIN EN ISO 2812-4, appendix A.4.5, "Artificial bird droppings," method A, 30 min at 45 °C		
2.3.5	Tree resin[b)] Testing as per DIN EN ISO 2812-4, appendix A.4.1, "Tree resin," method A, 30 min at 45 °C		
2.3.6	Mineral Oil and Fuel Standardization Committee (FAM) test fuel as per DIN 51604-2 Testing as per DIN EN ISO 2812-4, method A, 10 min at room temperature VW 50554 – 2		Only if required in the drawing. 1. 1 h at room temperature VW 50554 – 2: No visible changes, if changes occur, carry out step 2 2. 2 h at 60 °C reflow aging; No visible changes permitted, however, for small changes that are not relevant to the customer, consultation may be held with the purchaser.
2.3.7	E10 gasoline as per DIN EN 228 (blend of premium unleaded gasoline as per DIN EN 228 with 10 vol% ethanol p.a.) Testing as per DIN EN ISO 2812-4, method A, 10 min at room temperature VW 50554 – 2		
2.3.8	10% sulfuric acid (mass fraction) Testing as per DIN EN ISO 2812-4, method A, 1 h at room temperature VW 50554 – 2		
2.3.9	10% hydrochloric acid (mass fraction) Testing as per DIN EN ISO 2812-4, method A, 1 h at room temperature VW 50554 – 2		
2.4[c)]	Weathering tests[d)]; see section 4.5.		

Table 1 (continued)

No.	Property	Unit	Requirement
2.4.1	Kalahari simulation (dry-hot) as per PV 3929		No spots (patchiness, stripes, etc.) permissible on the visible side. Surface-wide changes of gray-scale grade ≥ 4 as per DIN EN 20105-A02 are permissible.
2.4.2	Florida simulation (humid-hot) as per PV 3930		
2.5[c)]	Color and gloss level as per VW 50196 and section 4.6		As per color combination table (FAKOM)
2.6	Density as per DIN EN ISO 1183-1 and section 4.7	g/cm³	As per data sheet of raw material manufacturer (±0,02)
2.7	Flexural strength, humid conditioned as per DIN EN ISO 178 and section 4.8	MPa	≥ 65
2.8	Flexural strength with modulus of elasticity, humid conditioned as per DIN EN ISO 178 and section 4.8	MPa	To be specified
2.9	Impact strength, dry conditioned as per DIN EN ISO 179-1/1fU and section 4.9	kJ/m²	No fracture (N) or partial fracture (P)
2.10[c)]	Notched impact strength, dry conditioned as per DIN EN ISO 179-1/1eA and section 4.10	kJ/m²	≥ 8,5 or no fracture (N) or partial fracture (P)
2.11[c)]	Vicat softening temperature, humid conditioned as per DIN EN ISO 306, method B50 and section 4.11	°C	≥ 90
3[c)]	Additional testing for ASA in high-gloss appearance		
	In addition to the tests in this TL, the requirements for the high-gloss surface must be fulfilled. The tests as per TL 52726 must be performed for this purpose. Only the additional tests are relevant.		

a) Applies only to impact-loaded functional parts in the front and rear areas of the vehicle

b) Applies only to parts in the directly visible area. Parts in the indirectly visible area (shadowed location) are exempt from this test, as the corresponding media cannot reach that area.

c) This must be verified in the reduced test scope for released materials.

d) For grained parts: Testing above one annual cycle required. For high-gloss parts, the weathering tests must always be performed since the processing has a high influence on the quality of the part.

4 Notes on testing

4.1 General information

The materials requirements must be taken from table 1. Requirements that go beyond this table must additionally be described in the drawing. The tests required for this must then be performed in addition.

4.2 Material

Identification can be performed using the attenuated total reflection variant of the FTIR procedure.

4.3 Low-temperature behavior with ball drop test

Ball drop test as per PV 3989.

Applies only to impact-loaded parts; pertinent information must be taken from the drawing and/or the Performance Specification.

Aging period:	24 h to 72 h at -30 °C
Specimen dimensions:	Flat finished-part sections of 70 mm × 70 mm If not possible otherwise, smaller sections can be taken from the finished part (see notes in PV 3989, "Support with recess" section)
Specimen support:	Base plate made of ≥ 10-mm-thick steel plate with recess (V1)
Ball mass:	(500 ±5) g
Ball drop height:	(650 ±10) mm
Ball impact point:	Specimen center on visible side

Procedure:

See PV 3989.

If only a chest freezer is available, the same procedure can be followed. Because cold air is heavier than warm air on top of it, the temperature level is maintained for some time before it mixes with the warm air. Nevertheless, the tests should not take longer than 3 minutes.

Requirements:

No fracture, no cracking.

4.4 Resistance to chemicals

The resistances to chemicals must be tested as per the information in table 1, consec. no. 2.3. Media that are not listed there but required for a test must be included separately in the drawing or in the Performance Specification.

Likewise, upon agreement with the purchaser's appropriate department, the scope may be reduced to the media relevant for the application. This agreement must also be specified in the drawing or in the Performance Specification. There must not be any changes such as signs of separation, swelling, discoloration, and/or cracking.

4.5 Weathering test

The specimens for testing as per PV 3929 and as per PV 3930, as well as a reference specimen for measuring the initial condition, must be taken from the finished parts.

4.6 Visual properties

Must be verified in the scope of initial sample inspection for unpainted visible surfaces.

Measuring points must be defined in consultation with the releasing department. If necessary, measuring points must also be placed in the transition area to adjacent parts with the same appearance.

4.7 Density

Testing as per DIN EN ISO 1183-1, buoyancy method.

Three specimens each must be tested, taken from different points in the finished part.

4.8 Flexural strength with modulus of elasticity (humid conditioned)

The flexural strength is determined at maximum force as per DIN EN ISO 178.

Age the specimens in the climatic chamber for 200 h at 55 °C and 80% humidity. Test the flexural strength as soon as the specimens have cooled to room temperature (VW 50554 – 2).

Specimen dimensions:	(80 ±2) mm × (10,0 ±0,2) mm × article thickness [mm]
Test speed:	14 mm/min
Modulus of elasticity test speed:	2 mm/min
Distance between supports:	(16 ±1) mm × product thickness (mm)
Support radius:	(2,0 ±0,2) mm for a specimen thickness ≤ 3 mm
	(5,0 ±0,2) mm for a specimen thickness of > 3 mm

The specimen must be placed on the supports of the testing device such that the front side of the finished part or the side of the specimen that corresponds to the visible side is loaded with the compressive force (test tool presses on the grained or high-gloss side of the specimen).

The specimens must be absolutely planar; no radius is permitted. The specimens must also be at right angles to the probe (test tool) on the support.

For an OK example of specimen placement, see figure 1.

For not OK (NOK) examples of specimen placement, see figure 2, figure 3, and figure 4.

At least 5 specimens must be tested.

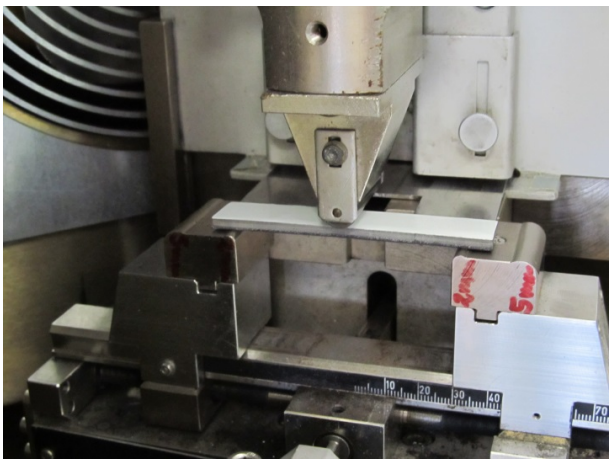


Figure 1 – OK: Specimen placement

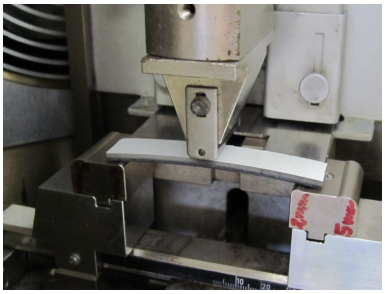


Figure 2 – NOK: Specimen curved upwards

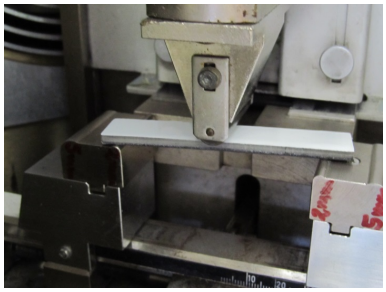


Figure 3 – NOK: Specimen at an angle on the support

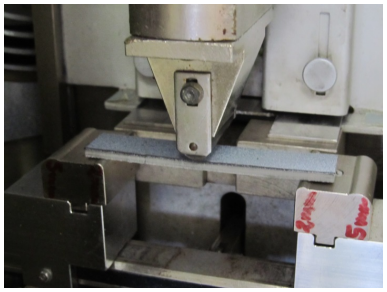


Figure 4 – NOK: Test tool presses onto the wrong side of the specimen

4.9 Impact strength (dry conditioned)

Testing as per DIN EN ISO 179-1/1fU.

Specimen dimensions:	(80 ±2) mm × (10 ±1) mm × product thickness (mm)
Distance between supports:	(62 +0,5) mm
Type:	Broadside impact

If the part geometry is unfavorable, a small dumb-bell specimen may be used:

Specimen dimensions:	(50 ±2) mm × (6 ±1) mm × product thickness (mm)
Distance between supports:	(40 + 0,5) mm
Type:	Broadside impact

Condition the specimens preferably in a vacuum drying oven for 120 h at 80 °C. If no corresponding vacuum drying oven is available, use a commercially available drying oven (without fresh air supply, in recirculation mode). In this case, extend the aging time to 168 h. After drying, cool the specimens to room temperature (VW 50554 – 2) in a desiccator filled with desiccant. Then perform the test.

Place the specimens on the supports of the test device in such a way that the front side of the finished part or the surface of the specimen that corresponds to the visible side faces the hammer edge.

The impact energy consumed must range between 25% and 75% (display on the measuring device). If the values go above or below these values, the next smaller or next larger hammer must be used.

The "no fracture" (N) requirement is met if the specimens are still in one piece after the impact strength test and there are no cracks entering the material.

A "partial fracture" (P) is present when the specimens are still in one piece after the impact strength test but cracks enter the material. The measured value which is output has no significance here as the result can be corrupted due to the specimen being "dragged".

A "hinge-type fracture" (H) is present if the specimens are still in one piece after the impact strength test, but the cracks entering the material are so large that the two halves of the specimen are only connected via a hinge-like thin film. In this case, the required "partial fracture" criterion is not fulfilled. The values might be corrupted in this case as well, because the impact energy consumed is not used 100 percent in the fracture formation and dragging of the specimen cannot be excluded here either.

4.10 Notched impact strength (dry conditioned)

Testing as per DIN EN ISO 179-1/1eA.

The tests must be performed on painted/grained components.

Specimen dimensions:	(80 ±2) mm × (10 ±1) mm × product thickness (mm)
Distance between supports:	(62 +0,5) mm
Notch root radius:	(0,25 ±0,05) mm
Type:	Narrow side impact

If the part geometry is unfavorable, a small dumb-bell specimen may be used:

Specimen dimensions:	(50 ±2) mm × (6 ±1) mm × product thickness (mm)
Distance between supports:	(40 + 0,5) mm

Notch root radius:	(0,25 ±0,05) mm
Type:	Narrow side impact

Condition the specimens as described in section 4.9.

Place the specimen on the supports so that the notch faces away from the hammer and is centered relative to the edge; see figure 5.

For NOK examples on how to place the specimen, see figure 6 and figure 7.

Examples with a dumb-bell specimen of 80 mm × 10 mm with V-notch.

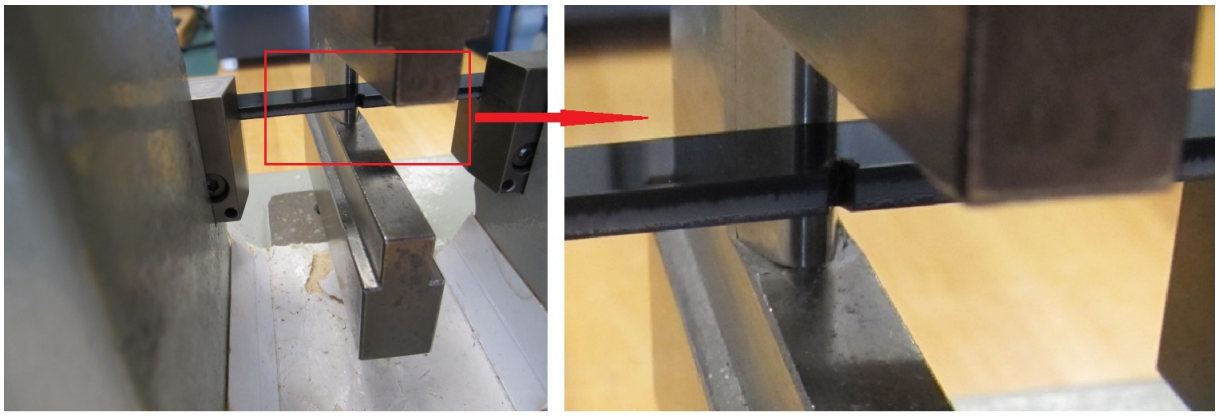


Figure 5 – OK: Hammer edge is centered relative to notch on opposite side

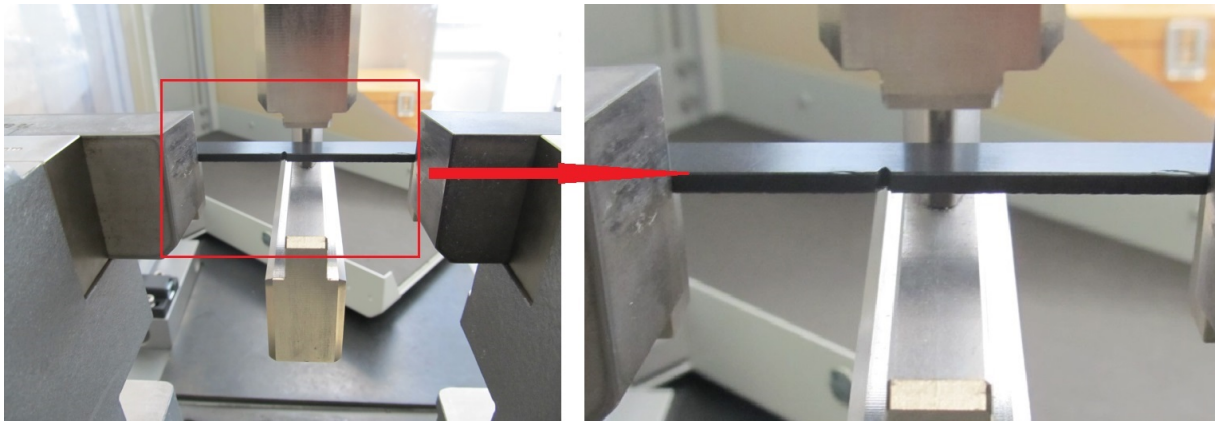


Figure 6 – NOK: Hammer edge is offset relative to notch on opposite side

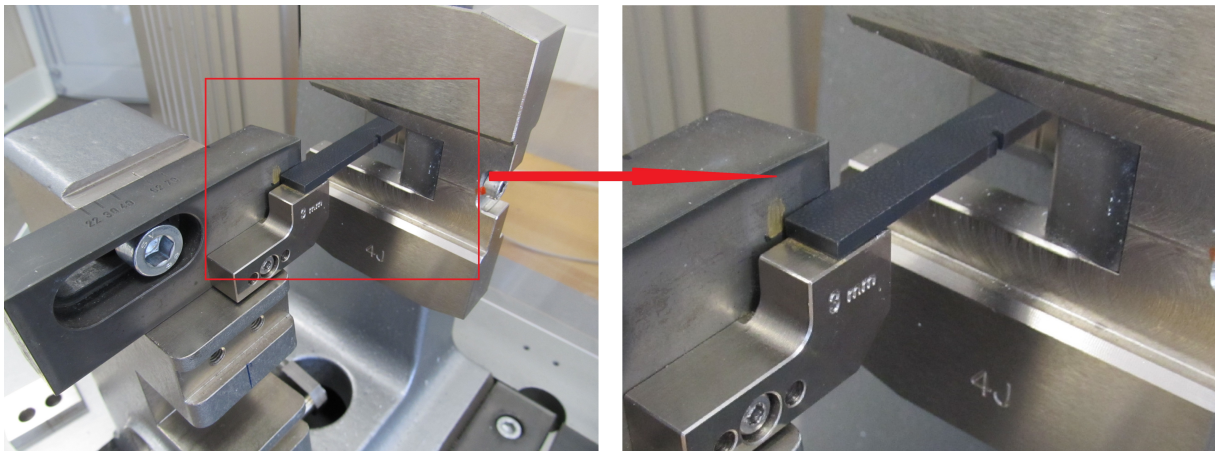


Figure 7 – NOK: Hammer edge is directly on the notch; specimen incorrectly mounted

The impact energy consumed must range between 25% and 75% (display on the measuring device). If the values go above or below these values, the next smaller or next larger hammer must be used.

The "no fracture" (N) requirement is met if the specimens are still in one piece after the impact strength test and there are no cracks going into the material from the notch root.

A "partial fracture" (P) is present if the specimens are still in one piece after the impact strength test but there are cracks going into the material from the notch root (see figure 8). The measured value which is output has no significance here as the result can be corrupted due to the specimen being "dragged".

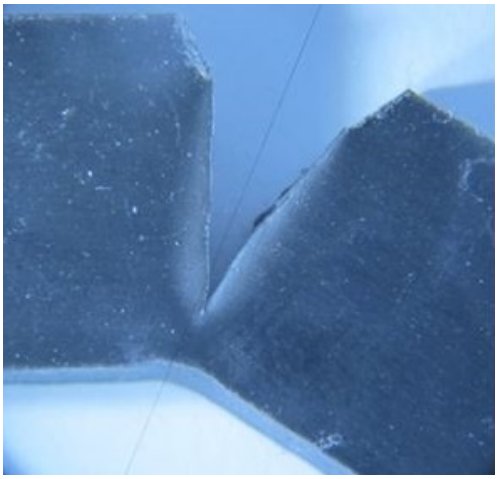


Figure 8 – Partial fracture

A "hinge-type fracture" (H) is present if the specimens are still in one piece after the impact strength test, but the cracks entering the material from the notch root are so large that the two halves of the specimen are only connected via a hinge-like thin film (see figure 9). In this case, the required "partial fracture" criterion is not fulfilled.

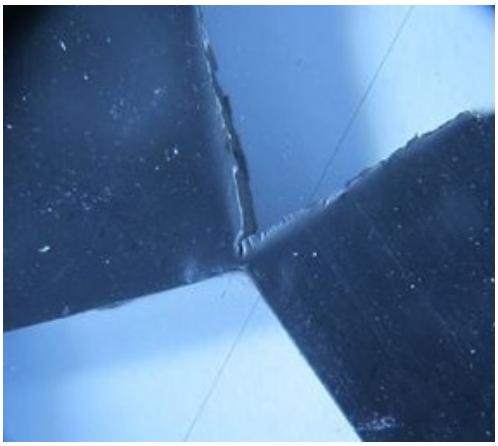


Figure 9 – Hinge-type fracture

Five specimens must be tested.

4.11 Vicat softening temperature (humid conditioned)

Testing as per DIN EN ISO 306, method B50

Age the specimens in the climatic chamber for 200 h at 55 °C and 80% humidity. Perform the test as soon as the specimens have cooled to room temperature (VW 50554 – 2).

Note on evaluation:

The Vicat softening temperature is made up of the temperature and application of force. The result of this method therefore provides no information on the maximum possible use temperature. This can be reduced further by the application of force. As a result, the function might no longer be ensured. The Vicat softening temperature can therefore only be used as an approximate gauge for possible use in the exterior area.

A definitive statement about the possible use of the finished part can only be made if information is available about the maximum occurring temperature and maximum forces applied to the finished part. This information must then be included in the measurement. This is currently not the case in DIN EN ISO 306 as the forces are specified there (10 N and 50 N).

The Vicat B50 measuring method must be used in order to include tensions in the installed condition (= force application).

4.12 Sampling (applies only to the tests in sections 4.8 to 4.10)

The sampling must be matched to the respective finished part. If the available surfaces are not large enough to take specimens of 80 mm × 10 mm, small dumb-bell specimens may also be used (see test descriptions). For covers that are substantially ribbed on the inside, take the specimens in such a way that they lie exactly between two ribs, or the ribs are located at the ends of the specimen where they can be removed with a scalpel.

An example of sampling is shown in figure 10.

During sampling, make sure that the specimens are planar and have no radii, because otherwise the test results could be corrupted.

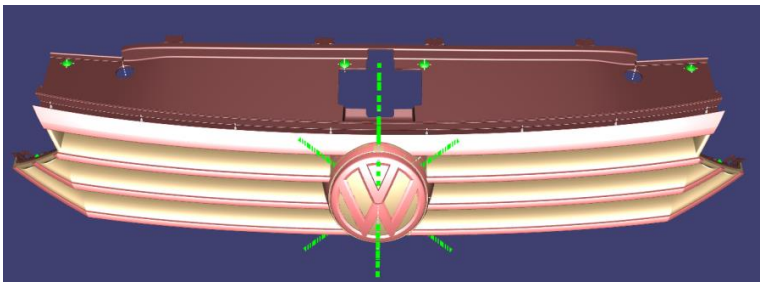


Figure 10 – Example of sampling

5 Applicable documents

The following documents cited in the standard are required for the application of this standard:

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.

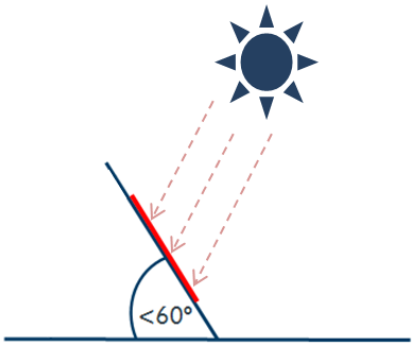
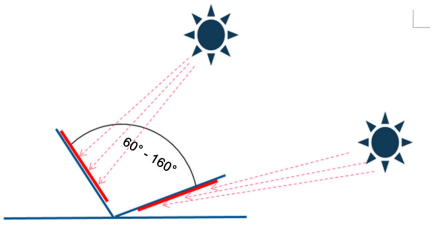
PV 3929 Non-Metallic Materials; Weathering in Dry, Hot Climate (Exterior)

PV 3930	Non-Metallic Materials; Weathering in Humid, Hot Climate (Exterior)
PV 3989	Kälteverhalten für Bauteile in Kunststoffausführung; Kugelfallprüfung
TL 52726	Plastic High-Gloss Applications in the Exterior Area - Requirements for the Surface
VW 01155	Vehicle Parts; Approval of First Supply and Changes
VW 50026	Granular Material for Components Made From Thermoplastics and Thermoplastic Elastomers; Classification and Basic Principles of Use
VW 50093	Porosity of Castings; Requirements; updated translation: 01-2013
VW 50185	Testing for Resistance to Open-Air Weathering on Whole Vehicles and of Components
VW 50196	Decorative Exterior Parts in Non-Body Color; Determining Color and Gloss
VW 50554	Standard Atmospheres and Room Temperatures; Requirements on Standard Atmospheres
VW 52000	Material Sample Inspection; Requirements and Documentation
VW 91101	Environmental Standard for Articles; Material and Chemical Conformity
DIN 51604-2	FAM-testing fluid for polymer materials - Composition and requirements - Part 2: Testing Fluid B, containing methanol
DIN EN 20105-A02	Textiles - Tests for colour fastness - Part A02: Grey scale for assessing change in colour
DIN EN 228	Automotive fuels - Unleaded petrol - Requirements and test methods
DIN EN ISO 1043-1	Plastics - Symbols and abbreviated terms - Part 1: Basic polymers and their special characteristics
DIN EN ISO 1043-2	Plastics - Symbols and abbreviated terms - Part 2: Fillers and reinforcing materials
DIN EN ISO 11469	Plastics - Generic identification and marking of plastics products
DIN EN ISO 1183-1	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method
DIN EN ISO 178	Plastics - Determination of flexural properties
DIN EN ISO 179-1	Plastics - Determination of Charpy impact properties - Part 1: Non-instrumented impact test
DIN EN ISO 2812-4	Paints and varnishes - Determination of resistance to liquids - Part 4: Spotting methods
DIN EN ISO 306	Plastics - Thermoplastic materials - Determination of Vicat softening temperature (VST)
DIN ISO 3696	Water for analytical laboratory use; specification and test methods
VDA 260	Components of motor vehicles; marking of material

Appendix A (normative) Weathering duration based on the part positions on the vehicle

See table A.1.

Table A.1

No.	Aging period	Part position (schematic)	
1	2 annual cycles		For part surfaces that are at an angle < 60° relative to the horizontal in their installation position, 2 annual cycles as per PV 3929 and PV 3930 apply.
2	1 annual cycle		For part surfaces that are at an angle between ≥ 60° and < 160° relative to the horizontal in their installation position, 1 annual cycle as per PV 3929 and PV 3930 applies. It must be ensured that the duration of the cycle is based on the most exposed surface. If subareas of the high-gloss surface are positioned at an angle smaller than 60°, the stricter test requirements apply (2 annual cycles).

Example:

See figure A.1.

Legend

1 Carrier

Figure A.1 – Passat B8

In this case, the UV test is not required, since the radiator grille carrier is in a direct shadowed location and light can only hit the relevant part when the sun is very low (as per figure A.1 and figure A.2). In the concrete example, it was possible to replace the originally used ASA with ABS.

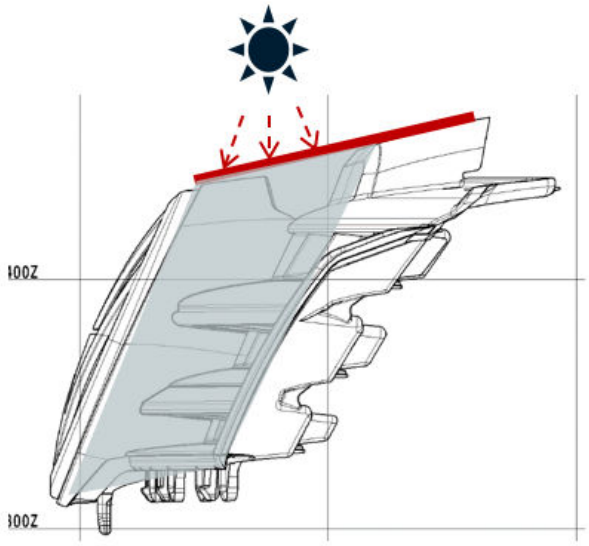


Figure A.2 – Lateral view of radiator grille/emblem

Appendix B (informative) List of released materials

The list of released materials is stored on the ONE.Konzern Business Plattform (ONE.KBP) – Volkswagen Group Supply (www.vwgroupsupply.com):

Start > Information > Divisions > Quality Assurance > Materials Engineering