No

Revision § 22a StVZO [Road Traffic Licensing Regulations], No. 29: Safety glass and plastic glazing

StV 32/301030103#
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I hereby announce Technical Requirements No 29 for safety glass and plastic glazing applicable to national vehicle type-approval procedures, e.g. national individual vehicle approvals under Regulation (EU) 2018/858.

Bundesministerium für Verkehr [Federal Ministry of Transport]

pp.

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1. Definitions and specifications

1.1 Armoured glass

Laminated glass consisting of an outer (in relation to the installation situation in the vehicle) pane[1] made of glass and one or more other panes made of glass or hard plastic, in which the individual panes are connected by plastic interlayers. Compared to conventional laminated glass, armoured glass must offer increased protection against attack or attack-like effects from the outside and be intended for special purposes (e.g. cash transporters, forestry machinery, etc.). Armoured glass may be used as a windscreen[2] or as another type of pane.

1.2 Plastic armoured glazing

Laminated glazing corresponding to armoured glass, with the difference that each individual pane is made of hard plastic.

1.3 Hard plastic panes for the driver's view in slow-moving motor vehicles

Individual windows made of monolithic hard plastic that are required for the driver's view[3] (e.g. windscreens or front side windows) in vehicles that, on account of their design, cannot travel faster than 40 km/h.

[1] The designations 'outer pane/partial laminate' and 'inner pane/partial laminate' and "external face' and 'internal face' used in this regulation always refer to the installation situation of the glazing in the vehicle.
[2] defined in UN-R43 ÄS01 incl. Addendum 11, Section 2.13
[3] defined in UN-R43 ÄS01 incl. Addendum 11, Section 2.25

Notified in accordance with Directive (EU) 2015/1535 of the European Parliament and of the Council of 9 September 2015 laying down a procedure for the provision of information in the field of technical regulations and of rules on Information Society services (OJ L 241, 17/9/2015, p. 1)

1.4 Plastic films for subsequent mounting on automotive glass

Single-layer or multilayer flexible plastic films in which the individual layers may be coloured, coated (e.g. metallic[4] or with a hard coating on the outer surface), perforated and/or printable. In the case of multilayer films, the individual film layers are connected by means of a laminating adhesive. Installation on the safety glass or plastic glazing shall be carried out by means of a mounting adhesive which is already applied on the mounting side of the film upon delivery, or is purely adhesive. The adhesives may also be coloured.

Areas and conditions of use:

Neither fluorescent films, films in signal or warning colours nor retroreflective or holographic films are permitted, be it through the design of the film itself or through any subsequent printing which may be approved.

The individual specifications and areas of use are specified in the component type-approval for the respective film type, in which the following areas of use, individually or combined, are generally eligible for approval:

The film may subsequently be mounted on the inside or outside of the glass or plastic pane, or on both sides (with certain combinations of film). Panes made of toughened safety glass (ESG), laminated safety glass (VSG), insulating glass units made up of two ESG panes, or plastic glazing can be retrofitted with films.

Window panes other than windscreens that are required for driver visibility (e.g. front side windows in cars) may only be coated with colourless films, provided that the window panes are colourless panes of glass under 6 mm in thickness. *(Note: This ensures that a minimum light transmission of 70% is not fallen short of. If necessary, an extension to tinted windows will be introduced at a later date, in which case a light transmission measurement will be required in an inspection by an officially recognised expert).*

Windscreens (WSS) may not be coated over their entire surface as a general rule, but only outside the vehicle type-specific visibility zones in accordance with UN-R43, which must be inspected by an officially recognised expert in an acceptance procedure.

(Exception: If the film sections (e.g. ‘colour wedges’ on the upper edge of the WSS) are smaller than 0.1 m² and cover a maximum of 25% of the WSS area, they are considered stickers in accordance with Verkehrsblattverlautbarung [Traffic Bulletin] No. 218 (see Section 1.5.1 of this Regulation) and are not subject to approval).

The use of films on emergency exits made of ESG in buses and coaches is usually explicitly included in the type approval.

General installation requirement: The film may only be clamped or connected to the window mount, frame or bonding if the film is cut continuously at the edge (in accordance with the type approval).

[4] In this case, the film is referred to as ‘metallised’.

1.5 Other specifications

The following subsequent measures on type-approved vehicle window panes are regulated by Traffic Bulletins [Verkehrsblattverlautbarungen – VkBl].

1.5.1 Placement of stickers on vehicle windows
No. 218, VkBl 1986 p. 557

1.5.2 Conditions for the repair of laminated glass windscreens
No. 55, VkBl 1986 p. 130
(Note: It is a good idea to update this traffic bulletin, as WSS are now generally glued in and constitute a load-bearing component (on which the airbag is also supported, for example), and to adapt to the (stricter) requirements for the repair providers themselves:
- Max. damage diameter (cf. car glass) approx. 25 mm (€2 coin),
- damage distance to the edge of the window pane min. 10 cm (due to pane stability and tool handling).
The exclusion of the far field of vision as well as the other conditions (not including 4.) under VkBl 1986 can be retained.)

2. Armoured glass windscreens

2.1 Principal characteristics

Shape and dimensions:
Armoured glass windscreens with the same principal characteristics, but for different vehicle types, are treated as belonging to the same group for the purpose of external impact resistance testing.

Nominal windscreen thickness:
A nominal thickness range can be approved if the high-temperature test and the moisture resistance and thermal shock resistance tests have been carried out on test pieces with minimum and maximum nominal thickness. On the other hand, the tests of the optical properties and, if applicable, the antenna and heating conductors as well as the temperature measurement during heating, must be carried out on entire windscreens of each type and structure (characterised by design, nominal thickness and order of the individual layers of the armoured glass laminate).
The permissible thickness tolerance results from the equation
Thickness tolerance (mm) = ± [(n x 0.2 mm) + (t_1 + t_2 + ... + t_m)]. N is the number of glass panes in the laminate, and t_1 to t_m are the manufacturing tolerances of the m individual hard plastic panes in the laminate, expressed in mm. These manufacturing tolerances depend on the manufacturing process of the individual panes and can be found in UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 1.1.6.
Number of glass panes

Glass chemical name

Possible special treatment of the glass panes (e.g. thermal tempering, conversion to glass ceramic)

Nominal thickness of the interlayer(s)

Nature and type of the interlayer(s)

In addition, if plastic panes are included in the laminate:

Number of plastic panes

Chemical name of the plastic material

Manufacturing process of the plastic pane(s)

Manufacturer of the plastic pane(s)

Type of surface coating of the plastic pane(s)

2.2 Secondary characteristics

Nominal thicknesses of the glass panes

Nominal thicknesses of the plastic panes (if any)

Type of glass (e.g. polished glass, float glass, sheet glass)

Colouring of the overall laminate

Colouring of the interlayer(s)

with or without electrical conductors

with or without obscuration bands

2.3 General

2.3.1 Test piece

In the case of armoured glass windscreens, the tests shall be carried out on flat test pieces which must be representative of the finished product, or on finished windscreens. All optical tests, including the testing of the antenna and heating conductors (if any) and, if applicable, the temperature measurement during heating, shall be carried out on complete windscreens of each type and structure. Depending on the property to be tested, the flat test pieces shall have either the structure of the complete laminate, or they shall be individual panes or multiple panes laminated together (partial laminates) from the overall laminate, which are representative of the behaviour of the armoured glass in the test in question. Instead of flat test pieces with the complete laminate structure, cut-outs from finished windscreens may also be used.

2.3.2 Conditioning of the test pieces

The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 96 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

2.4 Tests

The complete set of test pieces must fulfil the requirements for all tests except the chemical resistance test[5].

2.4.1 Abrasion test

[5] For the chemical resistance test, the permissible failure rate within a set of test pieces can be found in the test specification under 2.4.7.

2.4.1.1 Abrasion test on the external face

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 1,000 revolutions.
Test piece: Three flat test pieces of the single glass pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 100 mm. If glass outer panes of different nominal thicknesses are to be used, the nominal thickness of the three test pieces can be selected freely.
Requirement: The increase in light scatter after abrasion at 1,000 revolutions may not exceed 2 % for all test pieces.

2.4.1.2 Abrasion test on the internal face

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 100 revolutions.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the internal face of the windscreen (corresponding to installation in the vehicle), for the test on the internal face, measuring 100 mm x 100 mm. If plastic internal panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness shall be tested.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

2.4.2 High-temperature test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 5 with the following addition: The test pieces shall be placed in an oven that is heated up to 100 ºC (+0 / -2 ºC). Once the surface temperature of the test pieces has reached the temperature of the oven, the two-hour heat-soaking phase begins. The storage of the test pieces in the oven shall be discontinued after 24 hours at the latest, even if the test pieces have not yet reached the oven temperature or have not held up for a full two hours.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

2.4.3 Radiation resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 6.1 to 6.3.2.
Test piece: Three flat test samples of a two- or three-pane partial laminate of the armoured glass consisting of the outer two (i.e. first and second) glass panes and the first plastic pane (if present), measuring 300 mm x 76 mm. The glass panes and the plastic pane (if any) must have the smallest nominal thicknesses that appear in the laminate structures to be approved in these pane positions.

2.4.4 Moisture resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 7.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

2.4.5 Resistance to temperature change test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 8.

Test piece: Two flat test pieces from the complete laminate structure or two cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.größte Nenndicke ergeben.

2.4.6 Combustion behaviour test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 10.

Test piece: Five flat test pieces of the inner two-pane partial laminate of the armoured glass, i.e. of the inner plastic pane connected to the innermost glass pane (or of the two inner plastic panes if the second pane from the inside is also made of plastic), measuring 356 mm x 76 mm. The glass pane must have the smallest nominal thickness that appears in the laminated structures to be approved in this pane position. The plastic pane must have the largest nominal thickness appears at this pane position.

Requirement: The burning rate of all test samples may not exceed 90 mm/min.

2.4.7 Chemical resistance test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 11.1 to 11.2.3.2 (immersion test).

Test piece: Four flat test pieces, consisting of a laminate of the internal plastic pane and the innermost pane of the armoured glass, measuring 180 mm x 25 mm for each of the five test chemicals. The glass pane must have the smallest nominal thickness that appears in the laminated structures to be approved in this pane position. The plastic pane must have the largest nominal thickness appears at this pane position.

2.4.8 Optical qualities test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.

Test piece: Four complete windscreens of each type and structure, with electrical conductors (if present).

2.4.9 Test of the width and design of antenna and heating conductors

Only to be carried out if the windscreen has electrical conductors.

The requirements for the forward-facing field of vision of category M1 vehicles in accordance with UN-R125 ÄS02 incl. Addendum 3, Section 5.1.3 (a) and (b) on antenna conductors or heating conductors shall also be used for other categories of vehicles. Requirements regarding visual zone A are to be transferred to zones I and I'.

Test piece: All the test pieces for the optical properties test as per Section 2.4.8 of this Regulation.

2.4.10 Temperature measurement during heating

Only to be carried out if the windscreen can be heated.

The temperature measurement on the heated windscreen is carried out at an ambient temperature of (23 ± 2) °C.

Test piece: Two complete windscreens of each type and structure with electrical connections.

Requirement: The surface temperature must not exceed 70 ºC after a heating period of four hours.

2.4.11 Fracture structure test

Only to be carried out if the outer and/or inner pane of the armoured glass (corresponding to installation in the vehicle) have been pre-treated.

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 8, Section 4 with the following change: Section 4.5.2 is to be replaced as follows: A set of test pieces submitted for approval shall be considered satisfactory in terms of fracture structure if all test pieces have shown satisfactory results. Sections 4.5.2.1 and 4.5.2.2 are omitted.

Test piece: One or two flat test pieces of the outer and/or inner double-pane partial laminate of the armoured glass (corresponding to installation in the vehicle), if the outer and/or inner pane in the armoured glass laminate is pre-treated, measuring 1100 mm x 500 mm. If pre-treated panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

3. Armoured glass panes other than windscreens

3.1 Principal characteristics

Shape and dimensions:

Maximum circumscribed area, maximum segment height (if curved)

Nominal thickness of the armoured glass pane

A nominal thickness range can be approved if the high-temperature test and the moisture resistance and thermal shock resistance tests have been carried out on test pieces with minimum and maximum nominal thickness. On the other hand, the tests of the optical properties and, if applicable, the antenna and heating conductors as well as the temperature measurement during heating, must be carried out on test pieces of each structure (characterised by design, nominal thickness and order of the individual layers of the armoured glass laminate).

The permissible thickness tolerance results from the equation

Thickness tolerance (mm) = ± [(n x 0.2 mm) + (t_1 + t_2 + ... + t_m)]. N is the number of glass panes in the laminate, and t_1 to t_m are the manufacturing tolerances of the m individual hard plastic panes in the laminate, expressed in mm. These manufacturing tolerances depend on the manufacturing process of the individual panes and can be found in UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 1.1.6.

Number of glass panes

Glass chemical name

Possible special treatment of the glass panes (e.g. thermal tempering, conversion to glass ceramic)

Nominal thickness of the interlayer(s)

Nature and type of the interlayer(s)

In addition, if plastic panes are included in the laminate:

Number of plastic panes

Chemical name of the plastic material

Manufacturing process of the plastic pane(s)

Manufacturer of the plastic pane(s)

Type of surface coating of the plastic pane(s)

3.2 Secondary characteristics

Nominal thicknesses of the glass panes

Nominal thicknesses of the plastic panes (if any)

Type of glass (e.g. polished glass, float glass, sheet glass)

Colouring of the overall laminate

Colouring of the interlayer(s)

with or without electrical conductors

with or without obscuration bands

3.3 General

3.3.1 Armoured glass approved as a windscreen
The requirements of Section 3 of this Regulation shall be deemed to have been met if the pane of armoured glass has the same structure as an armoured glass windscreen already approved in accordance with Section 2 of this Regulation. Section 3.4.8 of this Regulation must be observed to ensure that the test results are transferrable to other types of panes of the same structure.

3.3.2 Test piece
In the case of armoured glass panes other than windscreens, the tests shall be carried out on flat test pieces which must be representative of the finished product, or on finished panes of armoured glass. For the optical tests, including the testing of the antenna and heating conductors (if present) and, if applicable, the temperature measurement during heating, specially manufactured test pieces can also be used as an alternative to finished panes of armoured glass, the shape and dimensions of which are to be chosen depending on the geometric characteristics of the finished products.
Depending on the property to be tested, the flat test pieces shall have either the structure of the complete laminate, or they shall be individual panes or multiple panes laminated together (partial laminates) from the overall laminate, which are representative of the behaviour of the armoured glass in the test in question. Instead of flat test pieces with the complete laminate structure, cut-outs from finished armoured glass panes may also be used.

3.3.3 Test piece conditioning
The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 96 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

3.4 Tests

The complete set of test pieces must fulfil the requirements for all tests except the chemical resistance test[6].

[6] For the chemical resistance test, the permissible failure rate within a set of test pieces can be found in the test specification under Section 3.4.7.

3.4.1 Abrasion test

3.4.1.1 Abrasion test on the external face

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 1,000 revolutions.
Test piece: Three flat test pieces of the single glass pane, which together constitute the external face of the armoured glass pane (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 100 mm. If glass outer panes of different nominal thicknesses are to be used, the nominal thickness of the three test pieces can be selected freely.
Requirement: The increase in light scatter after abrasion at 1,000 revolutions may not exceed 2 % for all test pieces.

3.4.1.2 Abrasion test on the internal face

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 100 revolutions.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the internal face of the armoured glass pane (corresponding to installation in the vehicle), for testing the inner surface, measuring 100 mm x 100 mm. If plastic internal panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness shall be tested.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

3.4.2 High-temperature test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 5 with the following addition: The test pieces shall be placed in an oven that is heated up to 100 ºC (+0 / -2 ºC). Once the surface temperature of the test pieces has reached the temperature of the oven, the two-hour heat-soaking phase begins. The storage of the test pieces in the oven shall be discontinued after 24 hours at the latest, even if the test pieces have not yet reached the oven temperature or have not held up for a full two hours.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished armoured glass panes, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the armoured glass panes, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

3.4.3 Radiation resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 6.1 to 6.3.2.
Test piece: Three flat test samples of a two- or three-pane partial laminate of the armoured glass consisting of the outer two (i.e. first and second) glass panes and the first plastic pane (if present), measuring 300 mm x 76 mm. The glass panes and the plastic pane (if any) must have the smallest nominal thicknesses that appear in the laminate structures to be approved in these pane positions.

3.4.4 Moisture resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 7.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished armoured glass panes, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the armoured glass panes, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

3.4.5 Resistance to temperature change test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 8.
Test piece: Two flat test pieces from the complete laminate structure or two cut-outs from finished armoured glass panes, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the armoured glass panes, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

3.4.6 Combustion behaviour test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 10.
Test piece: Five flat test pieces of the inner two-pane partial laminate of the armoured glass, i.e. of the inner plastic pane connected to the innermost glass pane (or of the two inner plastic panes if the second pane from the inside is also made of plastic), measuring 356 mm x 76 mm. The glass pane must have the smallest nominal thickness that appears in the laminated structures to be approved in this pane position. The plastic pane must have the largest nominal thickness appears at this pane position.
Requirement: The burning rate of all test samples may not exceed 90 mm/min.

3.4.7 Chemical resistance test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 11.1 to 11.2.3.2 (immersion test).
Test piece: Four flat test pieces, consisting of a laminate of the internal plastic pane and the innermost pane of the armoured glass, measuring 180 mm x 25 mm for each of the five test chemicals. The glass pane must have the smallest nominal thickness that appears in the laminated structures to be approved in this pane position. The plastic pane must have the largest nominal thickness appears at this pane position.

3.4.8 Optical qualities test

Only to be carried out if the pane of armoured glass is required for the driver's view.
Test based on UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9 with the following changes:
Instead of windscreens, finished armoured glass panes other than windscreens (e.g. side or rear windows) or specially manufactured test pieces are tested. The finished armoured glass panes are tested (the same way as with windscreens) at the angle of inclination corresponding to the angle of installation of the respective type of glass pane in the vehicle. The entire pane surface is tested in accordance with Section 9.2.5.3 (Zone I'), although a circumferential edge strip (on the inner and outer pane surface) 100 mm in width is excluded in accordance with Section 9.2.6.2. The test results are only valid for the tested pane type and structure.

Transferability of test results to other types of panes of the same structure:
If finished armoured glass panes or specially manufactured test pieces are tested, the test results can be transferred to other types of panes of the same structure, subject to certain limits. The panes must be tested for this purpose in both orientations, i.e. the test must be repeated after turning the panes by 90º around their surface normal[7]; this generally applies to

[7] If the requirements are only met in one of the two orientations, the component type-approval will be restricted accordingly with regard to the direction of production of the individual panes.

specially produced test pieces for which a real installation situation, characterised by orientation and installation angle of the pane, does not exist.
The maximum permissible circumscribed area and segment height of the armoured glass panes to be manufactured under this approval is determined by the circumscribed area and segment height of the tested panes. The angle of inclination chosen for the test must also not be exceeded when these prefabricated parts are installed.
Test piece: Four finished panes of armoured glass or four specially manufactured test pieces of each body, with electrical conductors (if any), with maximum circumscribed area and segment height to cover all armoured glass panes to be manufactured under the approval, except for windscreens.
Requirements: The light transmission of all test pieces must be at least 70 %. The maximum values specified in UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.6 (optical distortion test) and Section 9.3.5 (double image test) for visibility zone B (for windscreens in vehicles of categories M1 and N1) may not be exceeded by armoured glass panes other than windscreens required for driver vision (or by the test pieces representative of these panes).

3.4.9 Test of the width and design of antenna and heating conductors
Only to be carried out if the pane of armoured glass is required for the driver's view and has electrical conductors.
Antenna and heat conductors must not cause any significant visual obstructions. The maximum permissible widths of the electrical conductors of armoured glass panes other than windscreens must comply with the requirements for armoured glass windscreens set out in Section 2.4.9 of this Regulation.
Test piece: All the test pieces for the optical properties test as per Section 3.4.8 of this Regulation.

3.4.10 Temperature measurement during heating
Only to be carried out if the pane of armoured glass can be heated.
The temperature measurement on the heated pane of armoured glass is carried out at an ambient temperature of (23 ± 2) °C.
Test piece: Two complete panes of armoured glass of each structure with electrical connections.
Requirement: The surface temperature must not exceed 70 ºC after a heating period of four hours.

4. Plastic armoured glazing as windscreens

4.1 Principal characteristics

Number of individual panes

Chemical name of the component material of the individual panes

Manufacturing process of the individual panes

Manufacturer of the individual panes

Shape and dimensions:
Armoured glazing made of hard plastic panes used as windscreens with the same principal characteristics, but for different types of vehicles, shall be treated as belonging to a single group for the purpose of external impact resistance testing.

Nominal windscreen thickness:
A nominal thickness range can be approved if the high-temperature test and the moisture resistance and thermal shock resistance tests have been carried out on test pieces with minimum and maximum nominal thickness. On the other hand, the tests of the optical properties and, if applicable, the antenna and heating conductors as well as the temperature measurement during heating, must be carried out on entire windscreens of each type and structure (characterised by design, nominal thickness and order of the individual layers of the plastic laminate).
The permissible thickness tolerance results from the equation
Thickness tolerance (mm) = $\pm (t_1 + t_2 + \ldots + t_n)$, where t_1 to t_n are the manufacturing tolerances of the n individual hard plastic panes in the laminate, expressed in mm. These manufacturing tolerances depend on the manufacturing process of the individual panes and can be found in UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 1.1.6.

Nominal thickness of the interlayer(s)

Nature and type of the interlayer(s)

Any special treatment of the individual panes

Type of surface coating

4.2 Secondary characteristics

Nominal thicknesses of the individual panes

Colouring of the overall laminate

Colouring of the interlayer(s)

with or without electrical conductors or heating elements

with or without obscuration bands

4.3 General

4.3.1 Test piece

In the case of armoured glazing made of hard plastic panes used as windscreens, the tests shall be carried out on flat test pieces representative of the finished product or on finished windscreens. All optical tests, including the testing of the antenna and heating conductors (if any) and, if applicable, the temperature measurement during heating, shall be carried out on complete windscreens of each type and structure. Depending on the property to be tested, the flat test pieces shall have either the structure of the complete laminate, or they shall be individual panes or multiple panes laminated together (partial laminates) from the overall laminate, which are representative of the behaviour of the armoured glazing in the test in question. Instead of flat test pieces with the complete laminate structure, cut-outs from finished windscreens may also be used.

4.3.2 Test piece conditioning

The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 96 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

4.4 Tests

The complete set of test pieces must fulfil the requirements for all tests except the chemical resistance test[8].

4.4.1 Flexibility test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 3.
Test piece: One flat test piece of each individual plastic pane of the laminate measuring 300 mm x 25 mm.
This test only has to be carried out if the Technical Service deems necessary.

4.4.2 Abrasion test

4.4.2.1 Abrasion test of the external face

To test the abrasion resistance of the external face, either the Taber test under Section 4.4.2.1.1 of this Regulation or alternatively the combination of sand trickle test, car wash test and wiper test under Sections 4.4.2.1.2 to 4.4.2.1.4 of this Regulation can be carried out.

4.4.2.1.1 Taber test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.1.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 100 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

4.4.2.1.2 Sand trickle test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.2.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 50 mm x 50 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

[8] For the chemical resistance test, the permissible failure rate within a set of test pieces can be found in the test specification under Section 4.4.7.

4.4.2.1.3 Car wash test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.3.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 50 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

4.4.2.1.4 Wiper test
Test according to DIN ISO 5685: 2025-04.
(Note: The description of the wiper test in UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.4 is not sufficient to achieve the required accuracy and reproducibility. The description of the test method has been revised using ISO 5685 as an addendum to the description in UN-R43.)
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 150 mm x 100 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.
Requirement: The increase in light scatter after abrasion at 20,000 wiping cycles may not exceed 2 % for all test pieces.

4.4.2.2 Abrasion test on the internal face
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 100 revolutions.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the internal face of the windscreen (corresponding to installation in the vehicle), for the test on the internal face, measuring 100 mm x 100 mm. If plastic internal panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness shall be tested.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

4.4.3 Test of resistance to simulated weather conditions
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.2, in which tinted plastic panes and tinted interlayers each represent the higher level of difficulty.
Test piece: Three flat test pieces of the outer two-pane partial laminate of the armoured glazing (consisting of the two outer plastic panes), measuring 130 mm x 40 mm. The plastic panes must have the smallest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

4.4.4 Cross-cut test
Only to be carried out if the plastic product is coated.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.3.
Test piece: One of the test pieces from Section 4.4.3 of this Regulation.

4.4.5 Moisture resistance test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.4, with the following changes:
Instead of ten test pieces, only three test pieces are to be tested.
Section 6.4.4 is no longer applies.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

4.4.6 Combustion behaviour test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.5.
Test piece: Five flat test pieces each of the outer and inner two-pane partial laminate of the armoured glazing (from the outer and inner two plastic panes, respectively), measuring 356 mm x 76 mm. The plastic panes must have the largest nominal thicknesses found in the laminate structures to be approved on each of these pane positions. If the structure of the external and internal partial laminates is the same, it will suffice to test a single set of five test pieces.

4.4.7 Chemical resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.6.1 (Immersion test).
Test piece: Four flat test samples, consisting of a laminate of the outer and inner panes of the armoured glazing, measuring 180 mm x 25 mm, for each of the five test chemicals. The plastic panes must have the largest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

4.4.8 High-temperature test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.7 with the following addition:
The test pieces shall be placed in an oven that is heated up to 100 ºC (+0 / -2 ºC). Once the surface temperature of the test pieces has reached the temperature of the oven, the two-hour heat-soaking phase begins. The storage of the test pieces in the oven shall be discontinued after 24 hours at the latest, even if the test pieces have not yet reached the oven temperature or have not held up for a full two hours.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

4.4.9 Radiation resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.8 with the following changes:
The test must be carried out in any case.
Section 6.8.1 is to be replaced as follows: The test is carried out according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 6.1, in which colourless plastic panes and tinted interlayers each represent the higher level of difficulty.
Test piece: Three flat test pieces of the outer double-pane sub-laminate of the armoured glazing (from the outer two plastic panes), measuring 300 mm x 76 mm. The plastic panes must have the smallest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

4.4.10 Resistance to temperature change test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.9.
Test piece: Two flat test pieces from the complete laminate structure or two cut-outs from finished windscreens, measuring 300 mm x 300 mm. If a nominal thickness range is to be approved for the windscreens, a complete set of test pieces of each of the laminate structures resulting in the smallest and largest nominal thickness must be tested.

4.4.11 Optical qualities test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 7.

Test piece: Four complete windscreens of each type and structure, with electrical conductors (if present).

4.4.12 Test of the width and design of antenna and heating conductors

Only to be carried out if the windscreen has electrical conductors.

The requirements for the forward-facing field of vision of category M1 vehicles in accordance with UN-R125 ÄS02 incl. Addendum 3, Section 5.1.3 (a) and (b) on antenna conductors or heating conductors shall also be used for other categories of vehicles. Requirements regarding visual zone A are to be transferred to zones I and I'.

Test piece: All the test pieces for the optical properties test as per Section 4.4.11 of this Regulation.

4.4.13 Temperature measurement during heating

Only to be carried out if the windscreen can be heated.

The temperature measurement on the heated windscreen is carried out at an ambient temperature of (23 ± 2) °C.

Test piece: Two complete windscreens of each type and structure with electrical connections.

Requirement: The surface temperature must not exceed 70 ºC after a heating period of four hours.

5. Plastic armoured glazing other than windscreens

5.1 Principal characteristics

Number of individual panes

Chemical name of the component material of the individual panes

Manufacturing process of the individual panes

Manufacturer of the individual panes

Shape and dimensions:
Maximum circumscribed area, maximum segment height (if curved)

Nominal thickness of the plastic armoured glazing:
A nominal thickness range can be approved if the high-temperature test and the moisture resistance and thermal shock resistance tests have been carried out on test pieces with minimum and maximum nominal thickness. On the other hand, the tests of the optical properties and, if applicable, the antenna and heating conductors as well as the temperature measurement during heating, must be carried out on test pieces of each structure (characterised by design, nominal thickness and order of the individual layers of the plastic laminate).
The permissible thickness tolerance results from the equation
Thickness tolerance (mm) = ± (t_1 + t_2 + … + t_n), where t_1 to t_n are the manufacturing tolerances of n individual hard plastic panes in the laminate, expressed in mm. These manufacturing tolerances depend on the manufacturing process of the individual panes and can be found in UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 1.1.6.

Nominal thickness of the interlayer(s)

Nature and type of the interlayer(s)

Any special treatment of the individual panes

Type of surface coating

5.2 Secondary characteristics

Nominal thicknesses of the individual panes

Colouring of the overall laminate

Colouring of the interlayer(s)

with or without electrical conductors or heating elements

with or without obscuration bands

5.3 General

5.3.1 Armoured glazing approved as a windscreen
The requirements of Section 5 of this Regulation shall be deemed to have been fulfilled if the armoured glazing has the same structure as an armoured glazing made of hard plastic panes already approved in accordance with Section 4 of this Regulation and is used as a windscreen. Section 5.4.11 of this Regulation must be observed to ensure that the test results are transferrable to other types of panes of the same structure.

5.3.2 Test piece
In the case of armoured glazing made of hard plastic panes other than windscreens, the tests must be carried out on flat test pieces which must be representative of the finished product, or on finished armoured glazing. For the optical tests, including the testing of the antenna and heating conductors (if present) and, if applicable, the temperature measurement during heating, specially manufactured test pieces can also be used as an alternative to finished armoured glass glazing, the shape and dimensions of which are to be chosen depending on the geometric characteristics of the finished products.
Depending on the property to be tested, the flat test pieces shall have either the structure of the complete laminate, or they shall be individual panes or multiple panes laminated together (partial laminates) from the overall laminate, which are representative of the behaviour of the armoured glazing in the test in question. Instead of flat test pieces with the complete laminate structure, cut-outs from finished armoured glazing may also be used.

5.3.3 Test piece conditioning
The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 96 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

5.4 Tests

The complete set of test pieces must fulfil the requirements for all tests except the chemical resistance test[9].

5.4.1 Flexibility test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 3.

[9] For the chemical resistance test, the permissible failure rate within a set of test pieces can be found in the test specification under Section 5.4.9.

Test piece: One flat test piece of each individual plastic pane of the laminate measuring 300 mm x 25 mm.
This test only has to be carried out if the Technical Service deems necessary.

5.4.2 Abrasion test

5.4.2.1 Abrasion test of the external face

In the case of armoured glazing not required for driver visibility, the exterior abrasion resistance test is to be carried out by means of the Taber test described in Section 5.4.2.1.1.1 of this Regulation.
For armoured glazing that is required for driver visibility, either the Taber test under Section 5.4.2.1.1.2 of this Regulation or alternatively the combination of sand trickle test, car wash test and wiper test under to Sections 5.4.2.1.2 to 5.4.2.1.4 of this regulation can be carried out.

5.4.2.1.1 Taber test

5.4.2.1.1.1 Armoured glazing not required for driver visibility
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is to be carried out at 500 revolutions.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 100 mm. If plastic external panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.
Requirement: The increase in light scatter after abrasion at 500 revolutions may not exceed 10 % for all test pieces.

5.4.2.1.1.2 Armoured glazing required for driver visibility
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.1 with the following change:
In place of windscreens, armoured glazing made of hard plastic panes other than windscreens shall be tested.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 100 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

5.4.2.1.2 Sand trickle test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.2 with the following change:
In place of windscreens, armoured glazing made of hard plastic panes other than windscreens shall be tested.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 50 mm x 50 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

5.4.2.1.3 Car wash test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.3 with the following change:

In place of windscreens, armoured glazing made of hard plastic panes other than windscreens shall be tested.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 50 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.

5.4.2.1.4 Wiper test
Test according to DIN ISO 5685: 2025-04.
(Note: The description of the wiper test in UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.4 is not sufficient to achieve the required accuracy and reproducibility. The description of the test method has been revised using ISO 5685 as an addendum to the description in UN-R43.)
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 150 mm x 100 mm. If outer panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness is to be tested.
Requirement: The increase in light scatter after abrasion at 20,000 wiping cycles may not exceed 2 % for all test pieces.

5.4.2.2 Abrasion test of the internal face
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test). The test is carried out at 100 revolutions.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the internal face of the armoured glazing (corresponding to installation in the vehicle), for testing of the internal surface, measuring 100 mm x 100 mm. If plastic internal panes of different nominal thicknesses are to be used, a set of test pieces of each nominal thickness shall be tested.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

5.4.3 Test of resistance to simulated weather conditions
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 6.2, in which tinted plastic panes and tinted interlayers each represent the higher level of difficulty.
Test piece: Three flat test pieces of the outer two-pane partial laminate of the armoured glazing (consisting of the two outer plastic panes), measuring 130 mm x 40 mm. The plastic panes must have the smallest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

5.4.4 Cross-cut test
Only to be carried out if the plastic product is coated.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 6.3.
Test piece: One of the test pieces from Section 5.4.3 of this Regulation.

5.4.5 Moisture resistance test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 6.4, with the following changes:
Instead of ten test pieces, only three test pieces are to be tested.
Section 6.4.4 is no longer applies.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished armoured glazing, measuring 300 mm x 300 mm. If a nominal thickness range for

armoured glazing is to be approved, a complete set of test pieces of the laminate bodies resulting in the lowest and maximum nominal thickness shall be tested.

5.4.6 High-temperature test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 6.5 with the following addition:
The test pieces shall be placed in an oven that is heated up to 100 ºC (+0 / -2 ºC). Once the surface temperature of the test pieces has reached the temperature of the oven, the two-hour heat-soaking phase begins. The storage of the test pieces in the oven shall be discontinued after 24 hours at the latest, even if the test pieces have not yet reached the oven temperature or have not held up for a full two hours.
Test piece: Three flat test pieces from the complete laminate structure or three cut-outs from finished armoured glazing, measuring 300 mm x 300 mm. If a nominal thickness range for armoured glazing is to be approved, a complete set of test pieces of the laminate bodies resulting in the lowest and maximum nominal thickness shall be tested.

5.4.7 Radiation resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 6.6, with the following changes:
The test must be carried out in any case.
Section 6.6.1 is to be replaced as follows: The test is carried out according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 6.1, in which colourless plastic panes and tinted interlayers each represent the higher level of difficulty.
Test piece: Three flat test pieces of the outer double-pane sub-laminate of the armoured glazing (from the outer two plastic panes), measuring 300 mm x 76 mm. The plastic panes must have the smallest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

5.4.8 Combustion behaviour test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 8.
Test piece: Five flat test pieces each of the outer and inner two-pane partial laminate of the armoured glazing (from the outer and inner two plastic panes, respectively), measuring 356 mm x 76 mm. The plastic panes must have the largest nominal thicknesses found in the laminate structures to be approved on each of these pane positions. If the structure of the external and internal partial laminates is the same, it will suffice to test a single set of five test pieces.

5.4.9 Chemical resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 18, Section 9.1 (immersion test), with the following change:
Section 9.1.2: Instead of ‘glazing of class L’, ‘glazing necessary for the driver’s visibility’ shall be used.
Test piece: Four flat test samples, consisting of a laminate of the outer and inner panes of the armoured glazing, measuring 180 mm x 25 mm, for each of the five test chemicals. The plastic panes must have the largest nominal thicknesses found in the laminate structures to be approved on each of these pane positions.

5.4.10 Resistance to temperature change test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.9 with the following change:

In place of windscreens, armoured glazing made of hard plastic panes other than windscreens shall be tested.
Test piece: Two flat test pieces from the complete laminate structure or two cut-outs from finished armour glazing, measuring 300 mm x 300 mm. If a nominal thickness range for armoured glazing is to be approved, a complete set of test pieces of the laminate bodies resulting in the lowest and maximum nominal thickness shall be tested.

5.4.11 Optical qualities test

Only to be carried out if the armoured glazing is required for the driver's view.

Test based on UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9 with the following changes:
Instead of windscreens, finished armoured glazing made of hard plastic panes other than windscreens (e.g. side or rear windows) or specially manufactured test pieces are tested. The finished armour glazing is tested (the same way as with windscreens) at the angle of inclination corresponding to the angle of installation of the respective type of glass pane in the vehicle. The entire pane surface is tested in accordance with Section 9.2.5.3 (Zone I'), although a circumferential edge strip (on the inner and outer pane surface) 100 mm in width is excluded in accordance with Section 9.2.6.2. The test results are only valid for the tested pane type and structure.
Transferability of test results to other types of panes of the same structure:
If finished armoured glazing or specially manufactured test pieces are tested, the test results can be transferred to other pane types of the same structure, subject to certain limits. The panes must be tested for this purpose in both orientations, i.e. the test must be repeated after turning the panes by 90º around their surface normal[10]; this generally applies to specially produced test pieces for which a real installation situation, characterised by orientation and installation angle of the pane, does not exist.
The maximum permissible circumscribed area and segment height of the armoured glazing to be manufactured under this approval is determined by the circumscribed area and segment height of the tested panes. The angle of inclination chosen for the test must also not be exceeded when these prefabricated parts are installed.
Test piece: Four finished pieces of armoured glazing or four specially manufactured test pieces of each body, with electrical conductors (if any), with maximum circumscribed area and segment height to cover all pieces of armoured glazing to be manufactured under the approval, except for windscreens.
Requirements: The light transmission of all test pieces must be at least 70 %. The maximum values specified in UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.6 (optical distortion test) and Section 9.3.5 (double image test) for visibility zone B (for windscreens in vehicles of categories M1 and N1) may not be exceeded by armoured glazing made of hard plastic panes other than windscreens required for driver vision (or by the test pieces representative of these panes).

5.4.12 Test of the width and design of antenna and heating conductors

Only to be carried out if the armoured glazing is required for the driver's view and has electrical conductors.

Antenna and heat conductors must not cause any significant visual obstructions. The maximum permissible widths of the electric conductors of armoured glazing made of hard plastic panes other than windscreens shall comply with the requirements for windscreens set out in Section 4.4.12 of this Regulation.

[10] If the requirements are only met in one of the two orientations, the component type-approval will be restricted accordingly with regard to the direction of production of the individual panes.

Test piece: All the test pieces for the optical properties test as per Section 5.4.11 of this Regulation.

5.4.13 Temperature measurement during heating
Only to be carried out if the armoured glazing can be heated.
The temperature measurement on the heated armoured glazing is carried out at an ambient temperature of (23 ± 2) °C.
Test piece: Two complete pieces of armoured glazing of each structure with electrical connections.
Requirement: The surface temperature must not exceed 70 ºC after a heating period of four hours.

6. Hard plastic windscreens in slow-moving motor vehicles

6.1 Principal characteristics

Chemical name of the material

Manufacturing process

Shape and dimensions:
Hard plastic windscreens with the same principal characteristics, but for different vehicle types, shall be treated as belonging to a single group for the purpose of mechanical and external impact resistance testing.

Nominal thickness:
For extruded plastic products, the nominal thickness tolerance is ± 10 %. For plastic products manufactured using other processes (e.g. panes made of cast acrylic), the permissible thickness tolerance is given by the equation thickness tolerance (mm) = ± (0.4 mm + 0.1 x e), in which e is the nominal thickness of the pane in mm. The reference standard is ISO 7823-1.

Colouring of the plastic product

Type of surface coating

6.2 Secondary characteristics

with or without electrical conductors or heating elements

with or without obscuration bands

6.3 General

6.3.1 Test piece
In the case of hard plastic windscreens, the tests shall be carried out on flat test pieces which must be representative of the finished product, or on finished windscreens.

6.3.2 Test piece conditioning
The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 48 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

6.4 Tests

6.4.1 Flexibility test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 3.
Test piece: One flat test piece measuring 300 mm x 25 mm.

6.4.2 Phantom impact test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 4.
Test piece: Six complete windscreens from the series with the smallest circumscribed area and six complete windscreens from the series with the largest circumscribed area, selected in accordance with UN-R43 ÄS01 including Addendum 11, Annex 13, are to be tested.

6.4.3 Mechanical strength test with 227 g ball
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 5.
Test piece: Ten flat test pieces measuring 300 mm (+10/0 mm) x 300 mm (+10/0 mm) or ten essentially flat complete windscreens, one set of test pieces for each of the two test piece temperatures referred to in Sections 6.4.3.1 and 6.4.3.2 of this Regulation.

6.4.3.1 Test piece at ambient temperature (20 ± 5) °C
The ball drop test with test pieces at ambient temperature is only to be carried out following the moisture resistance test under Section 6.4.7 of this Regulation.

6.4.3.2 Test piece at (-18 ± 2) ºC
The procedure for the ball drop test on the cooled test pieces is the same as for testing the test pieces at ambient temperature.

6.4.4 Abrasion test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test).
The test is carried out at 100 revolutions.
Test piece: Three flat test pieces each measuring 100 mm x 100 mm for testing the external and internal face of the windscreen (corresponding to installation in the vehicle).
Note: In the case of identical coating of the external and internal face of the windscreen, it will suffice to test a single set of three test pieces.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

6.4.5 Test of resistance to simulated weather conditions
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.2.
Test piece: Three flat test pieces measuring 130 mm x 40 mm.

6.4.6 Cross-cut test
Only to be carried out if the plastic product is coated.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.3.
Test piece: One of the test pieces from Section 6.4.5 of this Regulation.

6.4.7 Moisture resistance test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.4.
Test piece: Ten flat test pieces measuring 300 mm (+10 / -0 mm) x 300 mm (+10 / -0 mm) or ten essentially flat complete windscreens.
After testing, the test pieces shall be stored for at least 48 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) % and then subjected to the test with the 227 g ball with test pieces at ambient temperature in accordance with section 6.4.3.1 of this Regulation.

6.4.8 Combustion behaviour test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.5.
Test piece: Five flat test pieces measuring 356 mm x 76 mm.

6.4.9 Chemical resistance test

6.4.9.1 Immersion test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.6.1 with the following change:
Section 6.6.1.2: The cross-cut as pre-treatment is not carried out for one of the four test samples for each test chemical.
Test piece: Four flat test pieces 180 mm x 25 mm for each of the five test chemicals.

6.4.9.2 Test under load

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.6.2.
Test piece: Four flat test pieces 180 mm x 25 mm for each of the five test chemicals.

6.4.10 Optical qualities test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 7.
Test piece: Four complete windscreens of each type, with electrical conductors (if present).

7. Hard plastic panes other than windscreens for driver visibility in slow-moving motor vehicles

7.1 Principal characteristics

Chemical name of the material

Classification of the material by the manufacturer:
Class of breaking behaviour under dynamic load

Manufacturing process

Shape and dimensions:
Maximum dimensions, maximum segment height (if curved)

Nominal thickness:
For extruded plastic products, the nominal thickness tolerance is ± 10 %. For plastic products manufactured using other processes (e.g. panes made of cast acrylic), the permissible thickness tolerance is given by the equation thickness tolerance (mm) = ± (0.4 mm + 0.1 x e), in which e is the nominal thickness of the pane in mm. The reference standard is ISO 7823-1.

Colouring of the plastic product

Type of surface coating

7.2 Secondary characteristics

with or without electrical conductors or heating elements

with or without obscuration bands

7.3 General

7.3.1 Hard plastic panes approved as windscreens
The requirements of Section 7 of this Regulation shall be deemed to have been fulfilled if the hard plastic windscreen has the same structure as a plastic windscreen already approved in accordance with Section 6 of this Regulation.

7.3.2 Test piece
In the case of panes made of hard plastic, the tests shall be carried out on flat test pieces which must be representative of the finished product, or on finished components.

7.3.3 Test piece conditioning
The protective packaging shall be removed from the test pieces and they shall be carefully cleaned before the test. They must be stored for 48 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) %.

7.3.4 Evaluation of fracture behaviour under dynamic load
To evaluate fracture behaviour under dynamic load, classes are created according to UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 4.3.2 to 4.3.4, depending on the use of the plastic glazing, taking into account the possibility of a head impact and for which different regulations for the phantom impact test apply.

7.4 Tests

7.4.1 Flexibility test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 3.
Test piece: One flat test piece measuring 300 mm x 25 mm.

7.4.2 Phantom impact test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 4.
Note: If the plastic glazing is classified as VIII/C in accordance with Section 7.3.4 of this Regulation, the phantom impact test can be omitted.
Test piece: Six flat test pieces measuring 1170 mm (+0 / -2 mm) x 570 mm (+0 / -2 mm) or six finished components.

7.4.3 Mechanical strength test with 227 g ball
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 5.
Test piece: Ten flat test pieces measuring 300 mm (+10/0 mm) x 300 mm (+10/0 mm) or ten essentially flat finished components, one set of test pieces for each of the two test piece temperatures referred to in Sections 7.4.3.1 and 7.4.3.2 of this Regulation.

7.4.3.1 Test piece at ambient temperature (20 ± 5) °C
The ball drop test with test pieces at ambient temperature is only to be carried out following the moisture resistance test under Section 7.4.7 of this Regulation.

7.4.3.2 Test piece at (-18 ± 2) ºC
The procedure for the ball drop test on the cooled test pieces is the same as for testing the test pieces at ambient temperature.

7.4.4 Abrasion test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test).
The test is carried out at 100 revolutions.
Test piece: Three flat test pieces each measuring 100 mm x 100 mm for testing the external and internal face of the glazing (corresponding to installation in the vehicle).

Note: In the case of identical coating of the external and internal face of the glazing, it will suffice to test a single set of three test pieces.
Requirement: The increase in light scatter after abrasion at 100 revolutions may not exceed 4 % for all test pieces.

7.4.5 Test of resistance to simulated weather conditions
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 6.2.
Test piece: Three flat test pieces measuring 130 mm x 40 mm.

7.4.6 Cross-cut test
Only to be carried out if the plastic product is coated.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 6.3.
Test piece: One of the test pieces from Section 7.4.5 of this Regulation.

7.4.7 Moisture resistance test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 6.4.
Test piece: Ten flat test pieces measuring 300 mm (+10 / -0 mm) x 300 mm (+10 / -0 mm) or ten essentially flat finished components.
After testing, the test pieces shall be stored for at least 48 hours at a temperature of (23 ± 2) °C and a relative humidity of (50 ± 5) % and then subjected to the test with the 227 g ball with test pieces at ambient temperature in accordance with Section 7.4.3.1 of this Regulation.

7.4.8 Combustion behaviour test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 8.
Test piece: Five flat test pieces measuring 356 mm x 76 mm.

7.4.9 Chemical resistance test

7.4.9.1 Immersion test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 9.1 with the following change:
Section 9.1.2: The cross-section as a pre-treatment of one of the four test pieces for each test chemical shall is not carried out under any circumstances.
Test piece: Four flat test pieces 180 mm x 25 mm for each of the five test chemicals.

7.4.9.2 Test under load

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 14, Section 9.2.
Test piece Four flat test pieces 180 mm x 25 mm for each of the five test chemicals.

7.4.10 Light transmission test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1.
Test piece: Four test pieces or four finished components.
Note: The initial light transmission values from the test of resistance to simulated weather conditions and from the moisture resistance test (Sections 7.4.5 and 7.4.7 of this Regulation respectively) may be used.
Requirement: The light transmission of all test pieces must be at least 70 %.

8. Plastic films for subsequent mounting on automotive glass and on automotive plastic panes

8.1 Principal characteristics

Film manufacturer

Film material

Manufacturing process

Number of film layers

Nominal thickness of the film (including assembly adhesive)

Type of laminating adhesive

Type of mounting adhesive

Metallisation (yes/no)

Perforation (yes/no)

Use of a cover film (protective film on the outside: yes/no)

8.2 Secondary characteristics

Film layer colours

Glue colours

Degree of directional reflection (if metallised)

Additional coating (if applicable, e.g. hard coating on the external surface)

Free area (in %) and hole diameter (if perforated)

Printing process and type of ink (if printable)

8.3 General

8.3.1 Test piece

The film sections for testing shall either be supplied by the applicant in the required dimensions or cut out accordingly by the Technical Service from delivered goods by the meter (e.g. film rolls measuring 10.0 m x 1.5 m).
The flexibility and bending test as well as the measurement of the film thickness are carried out on film sections without backing glass after other backing layers or protective masks (which must be removed before installation on the vehicle windscreen in accordance with the manufacturer's instructions) have been removed. The remainder of the tests are to be carried out on sections of film which have been mounted by the Technical Service on the carrier glass required for each test in accordance with the manufacturer's processing instructions. The Technical Service may also request the applicant to submit portions of film already mounted on pieces of carrier glass or to provide the uncoated pieces of carrier glass to the Technical Service.

8.3.2 Test piece conditioning
Before starting the tests, the test pieces prepared in accordance with Section 8.3.1 of this Regulation shall be stored for at least two weeks at (20 ± 5) ºC and (60 ± 20) % rel. humidity and then for at least 48 h at (23 ± 2) ºC and (50 ± 5) % rel. humidity.

8.3.3 Selection of the least favourable variants to reduce the scope of the testing (for the burning behaviour, phantom impact and fracture structure tests only)
Depending on the size of the variants and the degree of variation, the following variants may preferably be tested as the most difficult variants:
Colour variants: different basic colours, faintest and deepest colouring (with the same colour);
Perforated films: Hole pattern with maximum coverage (smallest recessed area);
Printable films: without printing and with printing using the most commonly used printing process with highly opaque colours, possibly containing solvents.
In addition, it is possible to mix sets of test pieces from similar variants.

8.4 Tests

8.4.1 Flexibility and bending test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 12.
Test piece: One test piece of the film (without backing layers or protective masks) per variant, i.e. with different secondary characteristics, measuring 300 mm x 25 mm.
Requirement: The film must meet the requirements of UN-R43 ÄS01 including Addendum 11, Annex 3, Section 12.4 for flexible plastics.
This test shall only be carried out if the Technical Service deems it necessary due to unusually high rigidity of the film.

8.4.2 Film thickness measurement
Test piece: One test piece of the film (without carrier layers or protective masks) per variant, i.e. with different secondary characteristics. In the case of printable films, samples are tested that are printed over the entire surface with the various printing processes and types of printing ink in highly opaque colours. The measurement is carried out using a calibrated measuring probe with a measuring force of (0.5 ± 0.3) N and an accuracy of 0.001 mm.
Requirement: The nominal thickness must be within the production tolerance specified by the film manufacturer. (Note: Tolerances greater than ± 20 % are generally not permitted).

8.4.3 Reflectance measurement
Only to be carried out if the film is metallised.
Determination of the degree of directional reflection in accordance with DIN 5036-3:1979-11 when light falls on the outside of the film-coated glass (corresponding to installation in the vehicle).
Test piece: One test piece per variant, film applied to flat, 3 mm thick, colourless float glass measuring approx. 100 mm x 100 mm.
Requirement: The degree of directed reflection may not exceed 25 % for coated side and rear windows and partially coated windscreens (outside the visibility zones) and 50 % for coated roof windows.

8.4.4 Combustion behaviour test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 10.
Test piece: Five test pieces per colour variant, film applied to flat, 3 mm thick float glass measuring 356 mm x 75 mm.
Requirement: The burn-off speed may not exceed 110 mm/min for all test pieces.

8.4.5 Film adhesive compatibility test

Only to be carried out if the film is to be installed on plastic panes.

The film adhesive must be chemically compatible with the plastic pane.

Test piece: One colourless, flat, 3 mm thick plastic sheet each, film-coated on one side, measuring approx. 100 mm x 100 mm, consisting of uncoated PMMA, uncoated PC and PC coated with polysiloxane.

Test: The test pieces are stored for 7 days at (23 ± 2) ºC and (50 ± 5) % rel. humidity. A visual inspection of the test pieces is then carried out within 24 hours thereafter.

Requirement: There must not be any visually detectable dissolution, decomposition or other damage to the plastic panes as a result of chemical incompatibility between the film adhesive and the plastic material.

8.4.6 Phantom impact test

8.4.6.1 Test of films for installation on single-pane safety glass (ESG) other than windscreens

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 3.1 at drop height 1.5 m (+0 / -5 mm).

Test piece: Four or six test pieces with one-sided or double-sided coating; film applied to flat, 4 mm thick, uniformly toughened glass (ESG) measuring 1100 mm (+5 / -2 mm) x 500 mm (+5 / -2 mm) with approval according to UN-R43 ÄS00 or ÄS01. The film shall be applied so that one circumferential edge of the test piece (clamping edge for fixation in the test frame) is not coated. For each delivery batch of carrier panes, the fracture behaviour of an uncoated toughened safety glass pane must first be verified in accordance with the requirements stated below.

The impact is made on the test piece side, which corresponds to the internal face of the windscreen (if the film is to be mounted on a vehicle windscreen). If toughened safety glass is coated on both sides, in addition to the four test pieces to be applied to the internal face, two further samples are applied to the external face.

Requirement: The film-coated glass must be almost completely knocked out of the test frame for all test pieces. The phantom head may not pass through the test piece in the form of a smaller hole (corresponding to its diameter) nor may it remain in the fractured pane.

8.4.6.2 Testing of films for installation on laminated safety glass (LSG) other than windscreens

Test according to UN-R43 ÄS00 incl. Addendum 14, Annex 7, Section 3 at drop height 1.5 m (+0 / -5 mm).

Test piece: Four test pieces; film applied to flat, approx. 4 mm thick, normal laminated glass (VSG) measuring 1100 mm (+5 / -2 mm) x 500 mm (+5 / -2 mm) with approval according to UN-R43 ÄS00 or ÄS01. The film shall be applied so that one circumferential edge of the test piece (clamping edge for fixation in the test frame) is not coated. For each delivery batch of carrier panes, the fracture behaviour of an uncoated pane of laminated glass must first be verified in accordance with the requirements stated below.

The impact is made on the test piece side, which corresponds to the internal face of the windscreen (if the film is to be mounted on a vehicle windscreen).

Requirement: All test pieces must fracture in accordance with UN-R43 ÄS00 incl. Addendum 14, Annex 7, Section 3.4.1.

8.4.6.3 Test of films for mounting on insulating glass units consisting of two panes of uniformly toughened glass

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 12, Section 3 at a drop height of 1.5 m (+0 / -5 mm).

Test piece: Six test pieces; film mounted on a flat insulating glass unit measuring 1100 mm (+5 / -2 mm) x 500 mm (+5 / -2 mm) with approval according to UN-R43 ÄS00 or ÄS01, consisting of two uniformly prestressed, 4 mm thick glass panes (ESG). The film shall be applied so that one circumferential edge of the test piece (clamping edge for fixation in the test frame) is not coated.
In addition to the four test pieces to be applied on the internal face, two further samples are applied on the external face. For each delivery batch of carrier panes, the fracture behaviour of an uncoated insulating glass unit must first be verified in accordance with the requirements stated below.
Requirement: Both panes of the film-coated insulating glass unit must be knocked almost completely out of the test frame for all test pieces. The phantom head may not pass through the test piece in the form of a smaller hole (corresponding to its diameter) nor may it remain in the fractured panes.

8.4.6.4 Testing of films for partial installation on laminated safety glass windscreens
Test according to UN-R43 ÄS00 incl. Addendum 14, Annex 6, Section 3.3 at a drop height of 4 m (+25 / -0 mm).
Test piece: Four test pieces; film applied to flat, approx. 4 mm thick, normal laminated glass for windscreens (VSG for WSS) measuring 1100 mm (+5 / -2 mm) x 500 mm (+5 / -2 mm) with approval according to UN-R43 ÄS00 or ÄS01. The film shall be applied so that the partial coating corresponds to the intended use (e.g. as a colour wedge strip along a long test piece edge) and one circumferential edge of the test piece (clamping edge for fixation in the test frame) is not coated. For each delivery batch of carrier panes, the fracture behaviour of an uncoated pane of laminated glass must first be verified in accordance with the requirements stated below.
The impact is made on the test piece side, which corresponds to the internal face of the windscreen (if the film is to be mounted on a vehicle windscreen).
Requirement: All test pieces must fracture in accordance with UN-R43 ÄS00 incl. Addendum 14, Annex 6, Section 3.3.3.1.

8.4.7 Fracture structure test
Not applicable if the film is to be used only on laminated safety glass or plastic panes.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 1.
Test piece: Flat support panes made of 4 mm thick, uniformly toughened glass (ESG) measuring 1100 mm (+5 / -2 mm) x 500 mm (+5 / -2 mm) with approval in accordance with UN-R43 ÄS00 or ÄS01. Five uncoated carrier panes per delivery batch and one fully film-coated pane are to be tested. (Note: The five uncoated ESG panes serve to verify the consistent quality of the carrier panes within the delivery batch.)
The stop is made at the geometric centre of the pane, preferably on the uncoated side; if both sides are coated, the stop side is optional.
Requirement: Depending on the approval of the carrier glass used, all test pieces must have a fracture structure in accordance with UN-R43 ÄS00 incl. Addendum 14, Annex 5, Section 2.6.1 or UN-R43 ÄS01 incl. Addendum 11, Annex 5, Section 2.6.1. A significant difference in the fracture structure between the film-coated test piece and the uncoated test pieces must not be detectable.

8.5 Additional tests for films for partial mounting on windscreens

In the case of film strips intended for such purposes as mounting as sunshade strips (‘colour wedges’) on the upper edge of the windscreen above the driver’s field of vision, the Technical Service may determine the maximum permissible height of the film strip from the vehicle-type-specific visual zone coordinates contained in the approval documents of the

windscreens in accordance with UN-R43. The film coating is then outside the visibility zones when correctly fitted to the vehicle type in question, which must be inspected by an officially recognised expert in an acceptance test. Proceed the same way for partial coatings other than such film tapes. If the Technical Service does not have access to the windscreen data, it may request the applicant to submit them.

8.6 Additional tests for films for mounting on windows for driver visibility other than windscreens

The complete set of test pieces must fulfil the requirements for all tests except for the chemical resistance test (see Section 8.6.9).

8.6.1 Test piece

For the abrasion test as well as the radiation resistance tests, weathering resistance and chemical resistance, flat carrier glasses made of 3 mm thick, colourless float glass are coated with film. The high-temperature test as well as the moisture resistance tests and resistance to temperature changes are carried out on film on flat carrier glass made of 4 mm thick, uniformly toughened glass (ESG). For the light transmission test and the test for clear and distortion-free visibility, the applicant must submit colourless, curved original side windows of any type of passenger vehicle with a film coating.

8.6.2 Abrasion test

8.6.2.1 Intended mounting on the internal face of the pane

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 4.1 to 4.6 (Taber test).
Test piece: Three test pieces measuring 100 mm x 100 mm; the film-coated surface is tested at 100 revolutions.
Requirement: The increase in light scatter after abrasion at 100 revolutions must not exceed 4 % for all test pieces.

8.6.2.2 Intended mounting on the external face of the pane

In the case of films for mounting on the external face of the windscreen, either the Taber test according to Section 8.6.2.2.1 of this regulation or alternatively the combination of sand trickle test, car wash test and wiper test according to Sections 8.6.2.2.2 to 8.6.2.2.4 of this Regulation can be carried out.

8.6.2.2.1 Taber test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.1 with the following change:
Instead of windscreens, pieces of film-coated carrier glass are tested.
Test piece: Three test pieces measuring 100 mm x 100 mm; the film-coated surface is tested.

8.6.2.2.2 Sand trickle test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.2 with the following change:
Instead of windscreens, pieces of film-coated carrier glass are tested.
Test piece: Three test pieces measuring 50 mm x 50 mm; the film-coated surface is tested.

8.6.2.2.3 Car wash test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.3 with the following change:
Instead of windscreens, pieces of film-coated carrier glass are tested.

Test piece: Three test pieces measuring 100 mm x 50 mm; the film-coated surface is tested.

8.6.2.2.4 Wiper test
Test according to DIN ISO 5685: 2025-04.
(Note: The description of the procedure for the wiper test in UN-R43 ÄS01 incl. Addendum 11, Annex 19, Section 6.1.4 is not sufficient to achieve the required accuracy and reproducibility. The description of the test method has been revised using ISO 5685 as an addendum to the description in UN-R43.)
Test piece: Three test pieces measuring 150 mm x 100 mm; the film-coated surface is tested.
Requirement: The increase in light scatter after abrasion at 20,000 wiping cycles may not exceed 2 % for all test pieces.

8.6.3 High-temperature test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 5.
Test piece: Three test pieces measuring 300 mm x 300 mm.

8.6.4 Radiation resistance test
Only to be carried out when installed on the internal face of the windscreen.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Sections 6.1 to 6.3.2.
Test piece: Three test pieces measuring 300 mm x 76 mm.

8.6.5 Test of resistance to simulated weather conditions
Only to be carried out if mounting on the outside of the pane is intended.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 17, Section 6.2.
Test piece: Three test pieces measuring 130 mm x 40 mm.

8.6.6 Cross-cut test
Only to be carried out if mounting on the outside of the pane is intended.
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 13.
Test piece: One of the test pieces from Section 8.6.5 of this Regulation.
Requirement: The cross-cut value Gt0 or Gt1 must be achieved.

8.6.7 Moisture resistance test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 7.
Test piece: Three test pieces measuring 300 mm x 300 mm.

8.6.8 Resistance to temperature change test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 8.
Test piece: Two test pieces measuring 300 mm x 300 mm.

8.6.9 Chemical resistance test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 11.2.1 (Immersion test).
Test piece: Four test pieces measuring 180 mm x 25 mm for each of the five test chemicals.
Requirements: The test result is satisfactory if the test piece shows no softening, sticky spots, cracks or obvious loss of transparency. Three of the four test pieces for each chemical must yield a satisfactory result.

8.6.10 Test for clear and distortion-free transparency
The test serves to demonstrate that the film can be mounted on motor vehicle windows (according to the manufacturer’s instructions) without causing any defects that could affect the driver’s view.

Test pieces and test methods: Four colourless, curved original side windows of any type of passenger vehicle with a film coating are visually inspected for bubbles, inclusions, opacities or other defects that impair visibility.
Requirement: All test pieces must be free of any visually disruptive defects.
Note: This test is also to be carried out as part of an acceptance test carried out by an officially recognised expert on each vehicle pane subsequently coated with the type-approved film (in the installed state) in order to ensure the correct mounting of the film, provided that this pane is important for the driver's visibility. It should also be checked that only colourless glass panes up to 6 mm thick have been coated.

8.6.11 Light transmission test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1.
Test piece: One of the test pieces from Section 8.6.10 of this Regulation.
Requirement: The light transmission must be at least 70 %.

9. In-house testing of production conformity

The definitions apply according to UN-R43 ÄS01 incl. Addendum 11, Annex 23, Section 1. In particular, a production sequence means the uninterrupted period of manufacture of the same type of product, comprising all glazing with the same principal characteristics on the same production line.
All the results of the in-house tests are to be documented.

The specified test frequencies are the minimum frequencies to be observed.

9.1 Armoured glass windscreens

9.1.1 Abrasion test on the internal face
Only to be carried out if the inner pane of the windscreen (as installed in the vehicle) is made of plastic.
Test according to Section 2.4.1.2 of this Regulation.
Test piece: Three flat test pieces[11] of the single plastic pane, which together represent the internal face of the windscreen (corresponding to installation in the vehicle), for testing the inner surface, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.1.2 High-temperature test
Test according to Section 2.4.2 of this Regulation.
Test piece: A section from a finished windscreen in the approximate dimensions 300 mm x 300 mm or a complete windscreen.
Frequency of testing: Once per 50 windscreens produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.1.3 Moisture resistance test
Test according to Section 2.4.4 of this Regulation.
Test piece: A section from a finished windscreen in the approximate dimensions 300 mm x 300 mm or a complete windscreen.

[11] In the case of curved components, test pieces of the flat single pane substrate can be tested which have undergone the coating process at the same time as the original panes.

Frequency of testing: Once per 50 windscreens produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.1.4 Chemical resistance test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.

Test according to Section 2.4.7 of this Regulation.
Test piece: Four flat test pieces, consisting of a laminate of the internal plastic pane and any pane of the armoured glass, measuring 180 mm x 25 mm for each of the five test chemicals. Alternatively, test pieces of the single plastic panes may be tested if the backs of these test pieces are suitably protected against the test chemicals.
Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.1.5 Light transmission test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1. In addition, if covers or cover strips are present, it must be checked that these are outside the reduced visibility zone B (for windscreens in vehicles of categories M1 and N1) in accordance with UN-R43 ÄS01 incl. Addendum 11, Annex 21, Section 2.4 or outside the visibility zone I (for windscreens in vehicles of categories M and N except M1) according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.2.3. For windscreens for agricultural or forestry vehicles or for construction site vehicles where the visibility zone I' according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.3 is relevant, it must be verified that the covers do not exceed the covered areas of the test pieces submitted for the approval test.
Test piece: One complete windscreen.
Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

9.1.6 Optical distortion test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.
Test piece and frequency of testing: Every windscreen produced must be tested.

9.1.7 Double image test

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.3.
Test piece and frequency of testing: Every windscreen produced must be tested.

9.1.8 Fracture structure test

Only to be carried out if the outer and/or inner pane of the armoured glass (corresponding to installation in the vehicle) have been pre-treated.

Test according to Section 2.4.11 of this Regulation.
Test piece: One test piece of the pre-treated external and/or internal single pane of the windscreen (corresponding to installation in the vehicle), if one or both of the panes have been pre-treated in the armoured glass laminate, in the original dimensions.
Frequency of testing: Once per production or delivery batch of pre-treated individual panes.

9.2 Armoured glass panes other than windscreens

The requirements of Section 9.2 of this Regulation are deemed to have been met if corresponding tests under Section 9.1 of this Regulation have been carried out on armoured glass windscreens from the same production sequence. In addition, each armoured glass

pane required for the driver's visibility is to be tested for visible defects in accordance with Sections 9.2.6 and 9.2.7 of this Regulation.

9.2.1 Abrasion test of the internal face

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.

Test according to Section 3.4.1.2 of this Regulation.

Test piece: Three flat test pieces[12] of the single plastic pane, which in the laminate constitutes the internal face of the pane of armoured glass (corresponding to installation in the vehicle), measuring 100 mm x 100 mm.

Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.2.2 High-temperature test

Test according to Section 3.4.2 of this Regulation.

Test piece: A section from a finished pane of armoured glass in the approximate dimensions 300 mm x 300 mm or a complete pane of armoured glass.

Frequency of testing: Once per 50 panes of armoured glass produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.2.3. Moisture resistance test

Test according to Section 3.4.4 of this Regulation.

Test piece: A section from a finished pane of armoured glass in the approximate dimensions 300 mm x 300 mm or a complete pane of armoured glass.

Frequency of testing: Once per 50 panes of armoured glass produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.2.4 Chemical resistance test

Only to be carried out if the inner pane of the armoured glass (according to the installation in the vehicle) is made of plastic.

Test according to Section 3.4.7 of this Regulation.

Test piece: Four flat test pieces, consisting of a laminate of the internal plastic pane and any pane of the armoured glass, measuring 180 mm x 25 mm for each of the five test chemicals. Alternatively, test pieces of the single plastic panes may be tested if the backs of these test pieces are suitably protected against the test chemicals.

Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.2.5 Light transmission test

Only to be carried out if the pane of armoured glass is required for the driver's view.

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1.

Test piece: One complete pane of armoured glass.

Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

9.2.6 Optical distortion test

Only to be carried out if the pane of armoured glass is required for the driver's view.

[12] In the case of curved components, test pieces of the flat single pane substrate can be tested which have undergone the coating process at the same time as the original panes.

Each armoured glass pane is to be visually tested for optical distortion.
In addition, armoured glass panes are to be tested with the frequency indicated below using the test procedure according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2, as amended in accordance with Section 3.4.8 of this Regulation.
Test piece: One complete pane of armoured glass.
Frequency of testing: Once per 5 panes of armoured glass produced of each product type, albeit at least once per production sequence.

9.2.7 Double image test
Only to be carried out if the pane of armoured glass is required for the driver's view.
The armoured glass panes are to be tested at the frequency indicated below with the procedure according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.3, as amended in accordance with Section 3.4.8 of this Regulation.
Test piece: One complete pane of armoured glass.
Frequency of testing: Once per 5 panes of armoured glass produced of each product type, albeit at least once per production sequence.

9.3 **Plastic armoured glazing as windscreens**

9.3.1 Abrasion test[13]

9.3.1.1 Abrasion test of the external face
The test of the abrasion resistance of the external face of the windscreen shall be carried out by means of the test procedure chosen for the type approval test, i.e. the Taber test under Section 9.3.1.1.1 of this Regulation or the combination of sand trickle test, car wash test and wiper test under Sections 9.3.1.1.2 to 9.3.1.1.4 of this Regulation.

9.3.1.1.1 Taber test
Test according to Section 4.4.2.1.1 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.3.1.1.2 Sand trickle test
Test according to Section 4.4.2.1.2 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 50 mm x 50 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

[13] In the case of curved components, test pieces of the flat single pane substrate can be tested which have undergone the coating process at the same time as the original panes in all abrasion tests under Section 9.3.1.

9.3.1.1.3 Car wash test
Test according to Section 4.4.2.1.3 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 100 mm x 50 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.3.1.1.4 Wiper test
Test according to Section 4.4.2.1.4 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the external face of the windscreen (corresponding to installation in the vehicle), for the test on the external face, measuring 150 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.3.1.2 Abrasion test of the internal face
Test according to Section 4.4.2.2 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which together constitute the internal face of the windscreen (corresponding to installation in the vehicle), for the test on the internal face, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.3.2 Test of resistance to simulated weather conditions
Test according to Section 4.4.3 of this Regulation.
Test piece: Three flat test pieces of the outer two-pane partial laminate of the armoured glazing (consisting of the two outer plastic panes), measuring 130 mm x 40 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.3.3 Cross-cut test
Not performed if the plastic product is not coated.
Test according to Section 4.4.4 of this Regulation.
Test piece and frequency of testing: One test piece from each set of test pieces according to Section 9.3.2 of this Regulation.

9.3.4 Moisture resistance test
Test according to Section 4.4.5 of this Regulation.
Test piece: A section from a finished windscreen in the approximate dimensions 300 mm x 300 mm or a complete windscreen.
Frequency of testing: Once per 50 windscreens produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.3.5 Chemical resistance test
Test according to Section 4.4.7 of this Regulation.
Test piece: Four flat test samples consisting of a laminate of the inner and outer panes of the armoured glazing, measuring 180 mm x 25 mm, for each of the five test chemicals. Alternatively, one test piece set each of the inner and outer plastic single panes can be tested if the backs of these test pieces are suitably protected against the test chemicals.
Frequency of testing: Once per production or delivery batch of each type of plastic inner pane and plastic outer pane used.

9.3.6 High-temperature test
Test according to Section 4.4.8 of this Regulation.
Test piece: A section from a finished windscreen in the approximate dimensions 300 mm x 300 mm or a complete windscreen.
Frequency of testing: Once per 50 windscreens produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.3.7 Light transmission test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1. In addition, if covers or cover strips are present, it must be checked that these are outside the reduced visibility zone B (for windscreens in vehicles of categories M1 and N1) in accordance with UN-R43 ÄS01 incl. Addendum 11, Annex 21, Section 2.4 or outside the visibility zone I (for windscreens in vehicles of categories M and N except M1) according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.2.3. For windscreens for agricultural or forestry vehicles or for construction site vehicles where the visibility zone I' according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.3 is relevant, it must be verified that the covers do not exceed the covered areas of the test pieces submitted for the approval test.
Test piece: One complete windscreen.
Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

9.3.8 Optical distortion test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.
Test piece and frequency of testing: Every windscreen produced must be tested.

9.3.9 Double image test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.3.
Test piece and frequency of testing: Every windscreen produced must be tested.

9.4 Plastic armoured glazing other than windscreens

The requirements of Section 9.4 of this Regulation are deemed to have been met if corresponding tests under Section 9.3 of this Regulation have been carried out on plastic armoured glazing as windscreens from the same production sequence. In addition, each piece of plastic armoured glazing required for the driver's visibility is to be tested for visible defects in accordance with Sections 9.4.8 and 9.4.9 of this Regulation.

9.4.1 Abrasion test[14]

9.4.1.1 Abrasion test of the external face
In the case of armoured glazing not required for driver visibility, the exterior abrasion resistance test is to be carried out by means of the Taber test described in Section 9.4.1.1.1.1 of this Regulation.
For armoured glazing required for driver visibility, the abrasion resistance test of the external face shall be carried out using the test method selected for the approval test, i.e. the Taber test under Section 9.4.1.1.1.2 of this Regulation or the combination of sand trickle test, car wash test and wiper test under Sections 9.4.1.1.2 to 9.4.1.1.4 of this Regulation.

9.4.1.1.1 Taber test

[14] In the case of curved components, test pieces of the flat pane substrate that have undergone the coating process parallel to the original panes may be tested during all abrasion tests as described in Section 9.4.1.

9.4.1.1.1.1 Armoured glazing not required for driver visibility
Test according to Section 5.4.2.1.1.1 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.1.1.1.2 Armoured glazing required for driver visibility
Test according to Section 5.4.2.1.1.2 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.1.1.2 Sand trickle test
Test according to Section 5.4.2.1.2 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 50 mm x 50 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.1.1.3 Car wash test
Test according to Section 5.4.2.1.3 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 100 mm x 50 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.1.1.4 Wiper test
Test according to Section 5.4.2.1.4 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the external face of the armoured glazing (corresponding to installation in the vehicle), for testing the external face, measuring 150 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.1.2 Abrasion test on the internal face
Test according to Section 5.4.2.2 of this Regulation.
Test piece: Three flat test pieces of the single plastic pane, which in the laminate constitutes the internal face of the armoured glazing (corresponding to installation in the vehicle), for testing of the internal surface, measuring 100 mm x 100 mm.
Frequency of testing: Once per production or delivery batch of each type of plastic inner pane used.

9.4.2 Test of resistance to simulated weather conditions
Test according to Section 5.4.3 of this Regulation.
Test piece: Three flat test pieces of the outer two-pane partial laminate of the armoured glazing (consisting of the two outer plastic panes), measuring 130 mm x 40 mm.

Frequency of testing: Once per production or delivery batch of each type of plastic outer pane used.

9.4.3 Cross-cut test

Not performed if the plastic product is not coated.

Test according to Section 5.4.4 of this Regulation.

Test piece and frequency of testing: One test piece from each set of test pieces as defined in Section 9.4.2 of this Regulation.

9.4.4 Moisture resistance test

Test according to Section 5.4.5 of this Regulation.

Test piece: A section of a finished armoured glazing measuring approximately 300 mm x 300 mm or a complete armoured glazing.

Frequency of testing: Once per 50 pieces of armoured glazing produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.4.5 High-temperature test

Test according to Section 5.4.6 of this Regulation.

Test piece: A section of a finished armoured glazing measuring approximately 300 mm x 300 mm or a complete armoured glazing.

Frequency of testing: Once per 50 pieces of armoured glazing produced of each product type, albeit at least once per production sequence. If interlayers of different colours are used, each colouring must be tested.

9.4.6 Chemical resistance test

Test according to Section 5.4.9 of this Regulation.

Test piece: Four flat test samples consisting of a laminate of the inner and outer panes of the armoured glazing, measuring 180 mm x 25 mm, for each of the five test chemicals. Alternatively, one test piece set each of the inner and outer plastic single panes can be tested if the backs of these test pieces are suitably protected against the test chemicals.

Frequency of testing: Once per production or delivery batch of each type of plastic inner pane and plastic outer pane used.

9.4.7 Light transmission test

Only to be carried out if the armoured glazing is required for the driver's view.

Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1.

Test piece: One complete armoured glazing.

Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

9.4.8 Optical distortion test

Only to be carried out if the armoured glazing is required for the driver's view.

Each piece of armoured glazing is to be visually tested for optical distortion.

In addition, armoured glazing is to be tested with the frequency specified below in accordance with UN-R43 ÄS01 including Addendum 11, Annex 3, Section 9.2, as amended in accordance with Section 5.4.11 of this Regulation.

Test piece: One complete armoured glazing.

Frequency of testing: Once per 5 produced pieces of armoured glazing of each product type, albeit at least once per production sequence.

9.4.9 Double image test

Only to be carried out if the armoured glazing is required for the driver's view.
The pieces of armoured glazing are to be tested with the frequency specified below in accordance with UN-R43 ÄS01 including Addendum 11, Annex 3, Section 9.3, as amended in accordance with Section 5.4.11 of this Regulation.
Test piece: One complete armoured glazing.
Frequency of testing: Once per 5 produced pieces of armoured glazing of each product type, albeit at least once per production sequence.

9.5 Hard plastic windscreens in slow-moving motor vehicles

9.5.1 Phantom impact test
Test according to Section 6.4.2 of this Regulation, but without HIC measurement.
Test piece: Complete windscreens.
Frequency of testing: 0.5 % of the daily production of windscreens on one production line, in which the sample selection must be representative of the production of the different windscreen models. A maximum of 15 windscreens should be tested per day.

9.5.2 Mechanical strength test with 227 g ball
Test according to Section 6.4.3, but only with test pieces to (-18 ± 2) ºC according to Section 6.4.3.2 of this Regulation.
Test piece: Cut-outs from finished windscreens, measuring 300 mm (+10 / -0 mm) x 300 mm (+10 / -0 mm), or complete windscreens.
Frequency of testing: 0.5 % of the daily production of windscreens on one production line. A maximum of 10 test pieces should be tested per day.

9.5.3 Abrasion test
Test according to Section 6.4.4 of this Regulation.
Test piece: Three flat test pieces[15], each measuring 100 mm x 100 mm, for testing the outside and inside of the windscreen (corresponding to installation in the vehicle).
Note: In the case of identical coating of the external and internal face of the windscreen, it will suffice to test a single set of three test pieces.
Frequency of testing: Once a month per product type.

9.5.4 Test of resistance to simulated weather conditions
Test according to Section 6.4.5 of this Regulation.
Test piece: Three essentially flat test pieces measuring 130 mm x 40 mm.
Frequency of testing: Once every three months per product type.

9.5.5 Cross-cut test
Not performed if the plastic product is not coated.
Test according to Section 6.4.6 of this Regulation.
Test piece and frequency of testing: One test piece from each set of test pieces as defined in Section 9.5.4 of this Regulation.

9.5.6 Chemical resistance test

9.5.6.1 Immersion test
Test according to Section 6.4.9.1 of this Regulation.
Test piece: Four essentially flat test pieces measuring 180 mm x 25 mm for each of the five test chemicals.
Frequency of testing: Once a month per product type.

[15] In the case of curved components, test pieces of the flat substrate can be tested which have undergone the coating process at the same time as the original panes.

9.5.6.2 Test under load
Test according to Section 6.4.9.2 of this Regulation.
Test piece: Four essentially flat test pieces measuring 180 mm x 25 mm for each of the five test chemicals.
Frequency of testing: Once a month per product type.

9.5.7 Light transmission test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1. In addition, if covers or cover strips are present, it must be checked that these are outside the reduced visibility zone B (for windscreens in vehicles of categories M1 and N1) in accordance with UN-R43 ÄS01 incl. Addendum 11, Annex 21, Section 2.4 or outside the visibility zone I (for windscreens in vehicles of categories M and N except M1) according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.2.3. For windscreens for agricultural or forestry vehicles or for construction site vehicles where the visibility zone I' according to UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.5.3 is relevant, it must be verified that the covers do not exceed the covered areas of the test pieces submitted for the approval test.
Test piece: One complete windscreen.
Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

9.5.8 Optical distortion test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.2.
Test piece: One complete windscreen.
Frequency of testing: 10 % of the daily production of windscreens on a production line, in which the sample selection must be representative of the production of the different windscreen models.

9.5.9 Double image test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.3.
Test piece: One complete windscreen.
Frequency of testing: 10 % of the daily production of windscreens on a production line, in which the sample selection must be representative of the production of the different windscreen models.

9.6 Hard plastic panes other than windscreens for driver visibility in slow-moving motor vehicles

The requirements of Section 9.6 of this Regulation are deemed to have been met if corresponding tests under Section 9.5 of this Regulation have been carried out on hard plastic windscreens in slow-moving motor vehicles which conform to the same product type or come from the same production sequence.

9.6.1 Mechanical strength test with 227 g ball
Test according to Section 7.4.3, but only with test pieces to (-18 ± 2) ºC according to Section 7.4.3.2 of this Regulation.
Test piece: Cut-outs from finished plastic panes, measuring 300 mm (+10 / -0 mm) x 300 mm (+10 / -0 mm), or complete plastic panes.
Frequency of testing: 0.5 % of the daily production of plastic panes on one production line. A maximum of 10 test pieces should be tested per day.

9.6.2 Abrasion test
Test according to Section 7.4.4 of this Regulation.
Test piece: Three flat test pieces[16], each measuring 100 mm x 100 mm, for testing the outside and inside of the glazing (corresponding to installation in the vehicle).
Note: In the case of identical coating of the external and internal face of the glazing, it will suffice to test a single set of three test pieces.
Frequency of testing: Once a month per product type.

9.6.3 Test of resistance to simulated weather conditions
Test according to Section 7.4.5 of this Regulation.
Test piece: Three essentially flat test pieces measuring 130 mm x 40 mm.
Frequency of testing: Once every three months per product type.

9.6.4 Cross-cut test
Not performed if the plastic product is not coated.
Test according to Section 7.4.6 of this Regulation.
Test piece and frequency of testing: One test piece from each set of test pieces according to Section 9.6.3 of this Regulation.

9.6.5 Chemical resistance test

9.6.5.1 Immersion test
Test according to Section 7.4.9.1 of this Regulation.
Test piece: Four essentially flat test pieces measuring 180 mm x 25 mm for each of the five test chemicals.
Frequency of testing: Once a month per product type.

9.6.5.2 Test under load
Test according to Section 7.4.9.2 of this Regulation.
Test piece: Four essentially flat test pieces measuring 180 mm x 25 mm for each of the five test chemicals.
Frequency of testing: Once a month per product type.

9.6.6 Light transmission test
Test as per UN-R43 ÄS01 incl. Addendum 11, Annex 3, Section 9.1.
Test piece: One complete plastic pane.
Frequency of testing: At least once at the beginning of each production sequence; additionally within the production sequence in the event of any changes in one of the secondary characteristics relevant to light transmission.

[16] In the case of curved components, test pieces of the flat substrate can be tested which have undergone the coating process at the same time as the original panes.

9.7 Plastic films for subsequent mounting on automotive glass

9.7.1 Test of characteristic film parameters

The characteristic parameters for the respective film type are to be determined at least once per production batch and compared with the specification of the material.
If the approval holder is not also the manufacturer that manufactures all the approval objects himself, he shall request the parameter documentation from the manufacturer at least once per delivery batch and carry out the comparison with the specification.

9.7.2 Film identity test

For each production batch and each variant, the film material is visually compared with reference samples in order to assess the conformity of the produced material with the material submitted for the approval tests on the basis of characteristics visible to the naked eye (colour, any visible reflective behaviour, hole pattern, etc.). If the approval holder is not also the manufacturer who manufactures all the objects of approval himself, he shall carry out the comparison once per delivery batch on his own reserve samples.

9.7.3 Film marking test

For each production or delivery batch and each variant, the marking on the film material must be checked for compliance with the approval specifications.

9.7.4 Film thickness measurement

Test according to Section 8.4.2 of this Regulation.
Test piece: One test piece of the film (without carrier layers or protective masks) per variant.
Frequency of testing: Once per production or delivery batch for each variant.

9.7.5 Reflectance measurement

Only to be carried out if the film is metallised.
Test according to Section 8.4.3 of this Regulation.
Test piece: One test piece per variant, film applied to flat, 3 mm thick, colourless float glass measuring approx. 100 mm x 100 mm.
Frequency of testing: Once per year. If the degree of directed reflection is more than 20 % (films for side and rear windows or for partial coating of windscreens) or 45 % (films for roof windows), the test shall be carried out once per production or delivery batch for each variant.