25-3 Safety Glass：Effective date from 2019/1/1

Refer to: R43 01-R3-C3,01-R3-C4,01-R3-C5,01-S4

25-3.1 Effective date and Scope:

25-3.1.1 Effective date from 2019/1/1, the new types of safety glass using in category L as entire or partial bodywork, and the new types of safety glass using in the cabin of category M and N（except for the special bullet-proof glazing, dashboard, double-windows ,small plastic glazing that is not required for either the driver's forward or rearward field of vision）, and effective date from 2021/1/1, all types of safety glass using in category L as entire or partial bodywork, and all types of safety glass using in the cabin of category M and N（except for the special bullet-proof glazing, dashboard, double-windows ,small plastic glazing that is not required for either the driver's forward or rearward field of vision）,shall comply with this regulation. The existing types which were confirmed to “25-2 Safety Glass ” shall comply with this regulation by its glass types as below：

25-3.1.1.1 For "rigid plastic panes", "rigid plastic multiple glazed units" and "flexible plastic panes" of existing types, shall conform to paragraphs 25-3.21 Resistance to simulated weathering and 25-3.23 Burning behaviour (fire-resistance) test in addition.

25-3.1.1.2 For "rigid plastic windscreens" and "laminated rigid plastic panes" of existing types, shall conform to paragraphs 25-3.21 Resistance to simulated weathering, 25-3.23 Burning behaviour (fire-resistance) test in addition.

25-3.1.1.3 For "laminated rigid plastic windscreens" of existing types shall conform to paragraphs 25-3.21 Resistance to simulated weathering, 25-3.22 Test of resistance to temperature changes and 25-3.23 Burning behaviour (fire-resistance) test in addition.

25-3.1.1.4 For "glass-plastics windscreens", "safety glazing faced with plastics material(on the inside) " and "glass-plastics panes" of existing types shall conform to paragraphs 25-3.22 Test of resistance to temperature changes, 25-3.23 Burning behaviour (fire-resistance) test in addition.

25-3.1.1.5 The exiting types other than paragraphs 25-3.1.1.1, 25-3.1.1.2, 25-3.1.1.3 and 25-3.1.1.4 could regard as conform to this regulation.

25-3.1.2 The applicants applying for low volume safety approval or vehicle-by-vehicle low volume safety approval could exempt from regulation of “safety glass” except large passenger vehicle and child-only vehicle.

25-3.2 Definitions:

25-3.2.1 "Toughened-glass" means glazing consisting of a single layer of glass which has been subjected to special treatment to increase its mechanical strength and to condition its fragmentation after shattering.

25-3.2.2 "Laminated-glass" means glazing consisting of two or more layers of glass held together by one or more interlayer of plastics material; it may be:

25-3.2.2.1 "Ordinary laminated glass", when none of the layers of glass of which it is composed has been treated; or

25-3.2.2.2 "Treated laminated glass", when at least one of the layers of glass, of which it is composed, has been specially treated to increase its mechanical strength and to condition its fragmentation after shattering;

25-3.2.3 "Interlayer" means any material designed to be used to hold together the component layers of laminated-glass.

25-3.2.4 "Safety-glass faced with plastics material" means glazing as defined in paragraphs 25-2 2.1. or 25-2 2.2. with a layer of plastics material on its inner face.

25-3.2.5 "Glass-plastics" means glazing consisting of any glazing material that comprises one layer of glass and one or more layers of plastic in which a plastic surface of the product faces the inner side.

25-3.2.6 "Plastic glazing" is a glazing material that contains as an essential ingredient one or more organic polymeric substances of large molecular weight, is solid in its finished state and, at some stage in its manufacture of processing into finished articles, can be shaped by flow.

25-3.2.6.1 "Rigid plastic glazing" means a plastic glazing material which does not deflect vertically more than 50 mm in the flexibility test.

25-3.2.6.2 "Flexible plastic glazing" means a plastic glazing material which deflects vertically more than 50 mm in the flexibility test.

25-3.2.6.3 "Laminated - rigid plastic pane" means a plastic pane consisting of two or more layers of plastic held together by one or more interlayers of plastic material.

25-3.2.6.4 "Laminated - rigid plastic windscreen" means a plastic windscreen consisting of two or more layers of plastic held together by one or more interlayers of plastic material.

25-3.2.7 "Double window" means an assembly of two panes separately installed within the same opening of the vehicle.

25-3.2.8 "Multiple-glazed unit" means an assembly of at least two parallel panes permanently assembled in manufacture and separated by one or more gap(s).

25-3.2.8.1 "Symmetrical multiple-glazed unit" means a multiple-glazed unit where all component panes are identical (e.g. all uniform toughened glass).

25-3.2.8.2 "Asymmetrical double-glazed unit" means a multiple-glazed unit other than a symmetrical multiple-glazed unit.

25-3.2.9 "Bullet resistant glazing" or "Bullet-proof glazing", means glazing constructed so as to be resistant to firearms.

25-3.2.10 "Windscreen" means the glazing in front of the driver through which the driver views the road ahead.

25-3.2.11 "Exterior forward-facing glazing" means any glazing other than a windscreen installed in the front of the vehicle body, representing a part of the vehicle exterior.

25-3.2.12 "Interior glazing" means any glazing installed in a vehicle passenger compartment (e.g. partitions, separating windows, etc.).

25-3.2.13 "Developed area of windscreen" means the minimum rectangular area of glass from which a windscreen can be manufactured.

25-3.2.14 "Inclination angle of a windscreen" means the angle included between on the one hand a vertical line and on the other hand a straight line passing through the top and bottom edges of the windscreen, both lines being contained in a vertical plane containing the longitudinal axis of the vehicle;

25-3.2.14.1 Measurement of the inclination angle shall be performed on a vehicle standing on level ground, and in the case of a passenger-transport vehicle the vehicle shall be in running order, shall be fully charged with fuel coolant and lubricant, and shall be

equipped with tools and the spare wheel or wheels (if they are provided as standard equipment by the vehicle manufacturer); allowance shall be made for the mass of the driver, and also, in the case of a passenger-transport vehicle, for that of one front-seat passenger, the mass of the driver and that of the passenger each being deemed to be 75 +/- 1 kg;

25-3.2.14.2 Vehicles equipped with hydropneumatic, hydraulic or pneumatic suspension or with a device for automatic adjustment of ground clearance according to load shall be tested in the normal running conditions specified by the manufacturer.

25-3.2.15 "Group of windscreens" means a group comprising windscreens of differing sizes and shapes subjected to an examination of their mechanical properties, their mode of fragmentation and their behaviour in environmental-aggression resistance tests.

25-3.2.15.1 "Flat windscreen" means a windscreen exhibiting no normal curvature resulting in a height of segment greater than 10 mm per linear meter;

25-3.2.15.2 "Curved windscreen" means a windscreen exhibiting a normal curvature resulting in a height of segment greater than 10 mm per linear meter.

25-3.2.16 "Pane" means any single piece of glazing other than a windscreen;

25-3.2.16.1 "Curved pane" means a pane with a height of segment "h" greater than 10 mm per linear meter;

25-3.2.16.2 "Flat pane" means a pane with a height of segment equal to or less than 10 mm per linear meter.

25-3.2.17 "Height of segment 'h' " means the maximum distance, measured at right angles approximately to the glazing, separating the inner surface of the glazing from a plane passing through the ends of the glazing.

25-3.2.18 "Nominal thickness": means the manufacturer's design thickness with a tolerance of +/- (n x 0.2 mm) where n equals the number of glass layers in the glazing.

25-3.2.19 "Curvature 'r' " means the approximate value of the smallest radius of arc of the windscreen as measured in the most curved area.

25-3.2.20 "HIC (Head Injury Criteria)" value means a value for the characteristics of skull-brain injury arising from the deceleration forces which result from a blunt perpendicular impact with the glazing.

25-3.2.21 "Safety glazing material requisite for driver visibility"

25-3.2.21.1 "Safety glazing material requisite for the driver's forward field of vision" means all the glazing situated in front of a plane passing through the driver's R point and perpendicular to the longitudinal median plane of the vehicle through which the driver can view the road when driving or manoeuvring the vehicle.

25-3.2.21.2 "Safety glazing material requisite for the driver's rearward field of vision" means all glazing situated behind a plane passing through the driver's R point and perpendicular to the longitudinal median plane of the vehicle through which the driver can view the road when driving or manoeuvring the vehicle.

25-3.2.22 "Opaque obscuration" means any area of the glazing preventing light transmission, including any screen-printed area, whether solid or dot-printed, but excluding any shade band.

25-3.2.23 "Shade band" means any area of the glazing with a reduced light transmittance, excluding any opaque obscuration.

25-3.2.24 "Transparent area of the windscreen" means the glazing area contained within the design glass outline, excluding any allowed opaque obscuration, but including any shade band.

25-3.2.25 "Design glass outline" means the design maximum unobstructed vehicle aperture designated to be glazed, before the glazing is installed or mounted, including all trims, but excluding obscuration bands.

25-3.2.26 "Optical distortion" means an optical defect in a windscreen that changes the appearance of an object viewed through the windscreen.

25-3.2.27 "Secondary image" means a spurious or ghost image, in addition to the bright primary image, usually seen at night when the object being viewed is very bright in relation to its surroundings, for example, the headlights of an approaching vehicle.

25-3.2.28 "Secondary image separation" means the angular distance between the position of the primary and secondary images.

25-3.2.29 "Regular light transmittance" means light transmittance measured perpendicularly to the glazing.

25-3.2.30 "Design seat-back angle" means the angle between the vertical line through the R point and the torso line defined by the vehicle

manufacturer.

25-3.2.31 "Sample" means a specially prepared piece of glazing representative of a finished product or a piece cut from a finished product.

25-3.2.32 "Test piece" means a sample or a finished product of glazing.

25-3.2.33 "Central driving position" is defined when Y co-ordinate of the R point is in Y0 position within + or -60 mm.

25-3.2.34 "Bodywork" means the external structure of the motor vehicle which comprises of fenders, doors, pillars, side walls, roof, floor, front bulkhead, rear bulkhead and/or other external panels

25-3.2.35 "Small glazing" is a pane having an area of less than 200 cm^2 and within which it is not possible to inscribe a circle having a diameter of 150 mm.

25-3.2.36 "Principal characteristic" means a characteristic that appreciably modifies the optical and/or mechanical properties of a safety glazing material in a way not without significance to the function which it is intended to perform in a vehicle. The term also covers the trade names or marks as specified by the holder of the approval (see Table 2).

25-3.2.37 "Secondary characteristic" means a characteristic capable of modifying the optical and/ or mechanical properties of a safety glazing material in a way which is of significance to the function which it is intended to perform in a vehicle. The extent of such modification is assessed in relation to the indices of difficulty (see Table 3).

25-3.2.38 The term "indices of difficulty" covers a two-stage grading system applying to the variations observed in practice in each secondary characteristic. A change from index "1" to index "2" indicates the need for additional tests (see Table 4).

25-3.3 Safety Glass and its installed stipulation

25-3.3.1 The safety glass of installed stipulation

25-3.3.1.1 Safety glazing shall be fitted in such a way that, despite the stresses to which the vehicles submitted under normal operating conditions, it remains in position and continues to afford visibility and safety to the occupants of the vehicle;

25-3.3.1.2 The category M and N of vehicles of stipulation

25-3.3.1.2.1 Windscreens

25-3.3.1.2.1.1 The regular light transmittance shall not be less than 70 per cent.

25-3.3.1.2.1.2 The windscreen must be correctly fitted with reference to the vehicle driver's 'R' point.

25-3.3.1.2.2 Safety glass except for windscreens.

25-3.3.1.2.2.1 The safety glazing through which the driver's forwards field of vision， must have a regular light transmittance of at least 70 per cent.

25-3.3.1.2.2.2 The safety glazing must have a light transmittance of at least 70 per cent, but where two exterior rear view mirrors are fitted, the glazing is allowed to have a light transmittance below 70 per cent.

25-3.3.1.3 Particular requirements for upper deck of a double-deck vehicle

25-3.3.1.3.1 The front exterior forward-facing glazing of the upper deck of a double-deck vehicle shall be constituted either by laminated glass or a plastic pane.

25-3.3.2 The safety glass panes shall be subjected to the tests listed in the following table. For "rigid plastic windscreens", "laminated rigid plastic panes" and "laminated rigid plastic windscreens" of safety glasses, the applicant could choose either Taber test or the set of sand drop, carwash and wiper test.

Scope / Tests	Windscreen				Glass panes other than windscreens							
	laminated-glass windscreens (L)	Rigid plastic windscreens	Laminated rigid plastic windscreens	Glass-plastics windscreens	Toughened-glass panes (T)	Laminated-glass panes (L)	Rigid plastic panes	Rigid plastic multiple glazed units	Flexible plastic panes	Laminated rigid plastic panes	Safety glazing faced with plastics material (on the inside)	Glass-plastics panes
Thickness test	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎
Fragmentation test	---	---	---	---	◎*2	---	---	---	---	---	---	---
227 g ball test	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	---	◎
2260 g ball test	◎	---	◎	◎	---	---	---	---	---	---	---	---
Headform test	◎	◎	◎	◎	---	---	◎*3	◎*3	---	◎	---	---
Test of resistance to abrasion	◎	◎*5	◎*5	◎	---	◎	◎*4	◎*4	---	◎*4*5	◎	◎
Test of resistance to high temperature	◎	---	◎	◎	---	◎	---	---	---	◎	---	◎
Resistance-to-radiation test	◎	---	◎	◎	---	◎	---	---	---	◎	---	◎
Resistance-to-humidity test	◎	◎	◎	◎	---	◎	◎	◎	---	◎	◎	◎
Light-transmission test	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	---	◎
Optical-distortion test	◎	◎	◎	◎	---	---	---	---	---	---	---	---
Secondary-image-separation test	◎	◎	◎	◎	---	---	---	---	---	---	---	---

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Test of flexible	---	◎	◎	---	---	---	◎	◎	◎	◎	---	---
Resistance to simulated weathering	---	◎	◎	---	---	---	◎	◎	◎	◎	---	---
Test of resistance to temperature changes	---	---	◎	◎	---	---	---	---	---	---	◎	◎
Burning behaviour (fire-resistance) test	---	◎	◎	◎	---	---	◎	◎	◎	◎	◎	◎

Note 1: laminated-glass pane（a glass pane consisting ofone layers of glass held together by multiple interlayers of plastics material;）

2：a glass pane consisting of a single layer of glass which has been subjected to special treatment to increase its mechanical strength and to condition its fragmentation after shattering;

3：For panes which do not have contact possibilities as well as a 150 mm diameter circle cannot be scribed, both of them will be exempt from the requirement.

4：For sun roofs, no test is required.

5：Plastic glazing materials either Taber test or the set of sand drop, carwash and wiper test.

25-3.4 Safety Glass shall according to suitable types and range of principle as below：

25-3.4.1 Trade name

25-3.4.2 Category of glass (toughened-glass， laminated-glass, rigid plastic panes, rigid plastic multiple glazed units, flexible plastic panes, laminated rigid plastic panes, safety glazing faced with plastics material(on the inside) and glass-plastics panes)

25-3.4.3 Nominal thickness

25-3.5 Thickness test:

25-3.5.1 for the Laminated glass （including laminated-glass pane, laminated-glass windscreens）, the nominal thickness can bear a tolerance of ±0.2 (n) mm, where n is the number of layers of glass.

25-3.5.2 For the toughened-glass pane, glass-plastics windscreens and glass-plastics panes the tolerance of can reach ±0.2 mm.

25-3.5.3 For Rigid plastic glazings （including rigid plastic windscreens）and rigid plastic double glazed units, The thickness tolerance limit of the nominal thickness. for extruded plastic products is +/ - 10 % of the nominal thickness. For plastic products produced by other techniques (e.g. cast acrylic sheet), the acceptable thickness tolerance is given by the equation (thickness tolerance limits (mm) = +/- (0.4 + 0.1 e) where e is the sheet thickness in mm.

25-3.5.4 Flexible plastic glazings , a manufacturing tolerance of the nominal thickness being allowed: is +/- (0.1 mm + 0.1e) where e is the sheet thickness in mm.

25-3.5.5 For laminated rigid plastic panes（including Laminated rigid plastic windscreens）,the nominal thickness of the pane, a manufacturing tolerance of $\pm n \cdot x$ mm being allowed ('n' being the number of layers of rigid plastic in the windscreen and x is the manufacturing tolerance of the single rigid plastic sheets in the pane.

25-3.5.6 For safety glazing faced with plastics material (on the inside), it could regard layers of plastic as toughened-glass or laminated-glass panes, the tolerance of nominal thickness shall according to paragraph 25-3.5.2 or 25-3.5.1.

25-3.6 Fragmentation test:

25-3.6.1 Number of samples: By using the complete products, four samples per set in the case of flat glass panes, or four samples per set in the case of curved glass panes that radius of curvature "r" is equal or more than 200 mm, or eight samples per set in the case of curved glass panes that radius of curvature "r" is less than 200 mm. Treated laminated-glass windscreens, One test piece measuring (1,100 x 500 mm) +5/-2 mm or one sample for each point of impact shall be subjected to testing.

25-3.6.1.1 For flat glass panes the points of impact represented respectively in figure7(a) and (b). For curved glass panes the points of impact represented in figure7-1,

25-3.6.2 A hammer of about 75 g or some other appliance giving equivalent results shall be used. The radius of curvature of the point shall be 0.2 +/- 0.05 mm. The fragmentation test should be held compliant with the following regulations:

25-3.6.2.1 Treated laminated-glass windscreens :

25-3.6.2.1.1 For each point of impact the fragmentation test shall be considered to have given a satisfactory result if the total surface area of fragments having a surface area of more than 2 cm2 comprised in a rectangle as（at least 20 cm high and 50m long）, represents not less than 15 per cent of the surface of that rectangle.

25-3.6.2.1.2 In the case of a sample:

25-3.6.2.1.2.1 For vehicles of category M1, the centre of the rectangle shall be situated within a circle having a radius of 10 cm centred on the projection of the middle of segment V1 V2.

25-3.6.2.1.2.2 For vehicles of categories M and N other than M1, the centre of the rectangle shall be situated within a circle having a radius of 10 cm centred on the projection of point 0.

25-3.6.2.1.2.3 The height of the above rectangle may be reduced to 15 cm for windscreens which are less than 44 cm high or whose angle of installation is less than 15 degrees from the vertical; the percentage of visibility shall at least be equal to 10 per cent of the area of Material Index of difficulty the corresponding rectangle.

25-3.6.2.1.3 In the case of a test piece, the centre of the rectangle shall be situated on the greater axis of the test piece at 450 mm from one of its edges.

25-3.6.2.1.4 When the test having been repeated on a new set of four test pieces for each point of impact for which it had originally given an unsatisfactory result, then four new tests performed at the same impact points shall be conducted and shall all give a satisfactory result.

25-3.6.2.2 For the toughened-glass pane not for use for windshield

25-3.6.2.2.1 The number of fragments in any 5cm x 5 cm square is not less than 40, A fragment extending across a side of a square shall count as half a fragment.

25-3.6.2.2.2 Fragmentation shall not be checked in a strip 20 mm wide round the edge of the samples, this strip representing the frame of the glass; nor within a radius of 75 mm from the point of impact. When a fragment extends beyond the excluded

area only the part of the fragment falling outside of the area shall be assessed. Fragments of an area exceeding 3 cm2 shall not be allowed.

25-3.6.2.2.3 A few fragments of elongated shape shall be allowed, provided that: their ends are not converge to a point, if they extend to the edge of the glass pane they do not form an angle of more than 45 degrees with it, and if, except in the case provided for in paragraph 25-2.6.2.2.4 below, their length does not exceed 100 mm.

25-3.6.2.2.4 Three of the four tests carried out at each of the points of impact above-mentioned have given a satisfactory result.

25-3.6.2.2.5 If the above-mentioned deviations are found, they shall be noted in the test report and permanent recording(s) of the fragmentation pattern of the relevant parts of the glass pane shall be attached to the report.

25-3.7 227 g ball test:

25-3.7.1 Test piece: The test piece shall be a flat square of side 300 +10/-0 mm

25-3.7.2 Condition the test piece at 23+/- 2 ℃ for at least four hours（Rigid plastic glazings and flexible plastic glazings must be stored for 48 hours，rigid plastic double glazed units must be stored for 24 hours） immediately preceding the test. The test is processed using a hardened-steel ball with a mass of 227 +/- 2 g and a diameter of approximately 38mm, and dropping the ball freely from a height specified in the following table or giving the ball a velocity equivalent to that obtained by the free fall. The point of impact shall be within 25 mm of the geometric centre of the test piece for a drop height less than or equal to 6 m, and within 50 mm of the centre of the test piece for a drop height greater than 6 m. The ball shall strike that face of the test piece, which represents the outside face of the safety-glazing pane when mounted on the vehicle.

25-3.7.2.1 The test conditions of laminated-glass pane ,glass-plastics panes are tabulated as below:

Scope	Amount of Tested Specimens/ Permitted first tested of un-satisfactory result	Height of fall(m) / Nominal thickness e (mm)	Temperature (^{O}C)		
			40±2	-20±2	20±5
Windscreen	10 / 2	e ≤ 4.5 4.5 <e ≤ 5.5 5.5 <e ≤ 6.5 6.5 <e	9 9 9 9	8.5 8.5 8.5 8.5	-
Glass panes other than windscreen	8 / 2	e ≤ 5.5 5.5 <e ≤ 6.5 6.5 <e	-	-	9m+25-0mm 9m+25-0mm 9m+25-0mm
glass-plastics panes	8 / 2	e ≤ 3.5 3.5 <e ≤ 4.5 4.5 <e	-	-	9m+25-0mm 9m+25-0mm 9m+25-0mm

25-3.7.2.2 A satisfactory result for laminated-glass pane ,glass-plastics panes:

25-3.7.2.2.1 Windscreen： The ball does not pass through the test piece and the test piece does not break into several pieces. If the interlayer is not torn, the weight of fragments detached from the side of the glass opposite to the point of impact must not exceed the appropriate values specified in the table below:

25-3.7.2.2.1.1 glass-plastics windscreens：The ball does not pass through the test piece and the test piece does not break into several pieces.

25-3.7.2.2.2 Glass panes other than windscreen：

25-3.7.2.2.2.1 The ball does not pass through the test piece.

25-3.7.2.2.2.2 The test piece does not break into several pieces.

25-3.7.2.2.2.3 At the point immediately opposite the point of impact, small fragments of glass may leave the specimen, but the small area thus affected shall expose less than 645 mm2 of reinforcing or strengthening material, the surface of which shall always be well covered with tiny particles of tightly adhering glass. Total separation of glass from the reinforcing or strengthening material shall not exceed 1,935 mm2 on either side. Spalling of the outer glass surface opposite the point of impact and adjacent to the area of impact is not to be considered a failure.

Scope	Nominal thickness e (mm)	Maximum permitted mass of the fragments, (g)
windscreen	e ≤ 4.5	12
	4.5 <e ≤ 5.5	15
	5.5 <e ≤ 6.5	20
	6.5 <e	25
Glass panes other than windscreen		15

A set of test pieces submitted for approval shall be considered satisfactory from the point of view of the 227 g ball test if at least eight of the ten tests carried out windscreen at each temperature, or at least six of the ten tests carried out glass panes other than windscreen at each temperature, have given a satisfactory result.

25-3.7.2.3 Six test pieces shall be subjected to testing for each thickness category, and the test condition is tabulated as follows:

Type	Nominal thickness e (mm)	Height of drop (m)
Toughened-glass pane	e ≤ 3.5	2. 0m +5-0 mm
	e > 3.5	2. 0m +5-0 mm

25-3.7.2.4 The test shall be deemed to have given a satisfactory result if at least five of the test pieces do not break..

25-3.7.2.5 Test conditions of rigid plastic glazings and rigid plastic double glazed units are listed in the table below:

Scope	Amount of Tested Specimens/ Amount of Qualified Specimens	Height of fall(m) / Nominal thickness e (mm)	Temperature (^{O}C)	
			-18±2	23±2
rigid plastic glazings and rigid plastic double glazed units	10 / ≥8	< 3	2	2
		4	3	3
		5	4	4
		>6	5	5

For intermediate values of thickness in the interval between 3 mm and 6 mm, the height of drop shall be interpolated.

25-3.7.2.6 The rigid plastic glazings and rigid plastic double glazed units ball test shall be considered to have given a satisfactory result if the following conditions are met: the ball does not penetrate the test piece, the test piece does not break into separate pieces.

25-3.7.2.7 Test conditions of flexible plastic glazings in the table below:

Scope	Amount of Tested Specimens/ Amount of Qualified Specimens	Height of fall(m) / Nominal thickness e (mm)	Temperature (^{O}C)	
			-18±2	23±2
flexible plastic glazings	10 / ≥8	All of thickness	2	2

25-3.7.2.8 The flexible plastic glazings ball test shall be considered to have given a satisfactory result if the following conditions are met: the ball does not penetrate the test piece.

25-3.7.2.9 The laminated rigid plastic panes and rigid plastic windscreens number of test pieces：

Ten flat square pieces of 300 +10/-0 mm side or ten substantially flat finished parts shall be subjected to testing. In this later case the contact between the part and the supporting fixture shall be around the whole perimeter and of about 15 mm width. Upper and lower supporting frames shall be clamped together in a way that ensures that the movement of the test piece during the test shall not exceed 2 mm.

25-3.7.2.9.1 The ambient temperature ball drop test shall be only performed after the humidity test of paragraph 25-3.13.3.2.3 in the table below:

Scope	Amount of Tested Specimens/ Amount of Qualified Specimens	Height of fall(m) / Nominal thickness e (mm)	Temperature (^{O}C) -18±2
laminated rigid plastic panes	10 / ≥8	All of thickness	6
rigid plastic windscreens	10 / ≥8	All of thickness	8.5

25-3.7.2.9.2 The ball test shall be considered to have given a satisfactory result if the following conditions are met for laminated rigid plastic panes , rigid plastic windscreens：

(a) The ball does not penetrate the test piece,

(b) The test piece does not break into separate pieces.

25-3.7.2.9.3 As a result of the impact, cracks and fissures in the test piece shall however be permitted.

25-3.7.2.10 The laminated rigid plastic windscreens number of test pieces：Number of test pieces twenty square test pieces of 300 +10/-0 mm or ten substantially flat finished parts shall be subjected to testing. In this later case the contact between the part and the supporting fixture shall be around the whole perimeter and of about 15 mm width. Upper and lower supporting frames shall be

clamped together in a way that ensures that the movement of the test piece during the test shall not exceed 2 mm.

25-3.7.2.10.1 To minimize the temperature change of the test piece, the test shall be performed within 30 seconds of the removal of the test piece from the conditioning appliance in the table below：

Scope	Amount of Tested Specimens/ Amount of Qualified Specimens	Height of fall(m) / Nominal thickness e (mm)	Temperature (^{O}C)	
			40±2	-18±2
laminated rigid plastic windscreens	10 / ≥8	All of thickness	9	8.5

25-3.7.2.10.2 The ball test shall be considered to have given a satisfactory result if the following conditions are met for laminated rigid plastic windscreens：

(a) The ball does not penetrate the test piece;

(b) The test piece does not break into separate pieces.

25-3.7.2.10.3 As a result of the impact, cracks and fissures in the test piece shall however be permitted.

25-3.8 2260 g ball test:

25-3.8.1 Twelve square test pieces of 300m+10/-0 side shall be subjected to testing.

25-3.8.2 Condition the test piece at 20 ± 5°C for at least four hours immediately preceding the test.

25-3.8.3 The test is processed using a hardened-steel ball mass of 2260 +/- 20 g and a diameter of approximately 82mm, and dropping the ball freely from a height of 4m or giving the ball a velocity equivalent to that obtained by the free ball. The point of impact shall be within 25mm of the geometric centre of the test piece. The ball shall strike that face of the test piece which represents the inward

face of the safety-glass pane when the latter is mounted on the vehicle.

25-3.8.4 The test shall be deemed to have given a satisfactory result if the ball does not pass through the glazing within five seconds after the moment of impact.

25-3.8.5 A set of test pieces submitted for approval shall be considered satisfactory from the point of view of the 2,260 g ball test if at least eleven of the twelve tests have given a satisfactory result.

25-3.9 Headform test:

25-3.9.1 For laminated-glass windscreens, glass-plastics windscreens

25-3.9.1.1 Test pieces：In the case of windscreen, four samples of complete windscreen shall be tested. In the case of glass panes (1,100 mm x 500 mm) +5/-2 (5/2) shall be subjected testing. Four tested for glass-plastics windscreens test pieces from the series having the smallest developed area and four complete windscreens test pieces from the series having the largest developed area.

25-3.9.1.2 The test piece shall be kept at a constant temperature of 20 ± 5℃ for at least four hours immediately preceding the test.

25-3.9.1.3 The total mass of the headform shall be 10 (±0.2) kg, and dropping the ball freely from a height of 1.5m+0/-5 mm or giving the ball a velocity equivalent to that obtained by the free ball. The weight shall strike the test piece within 40mm of the geometric centre on that face which represents the inward face of the safety-glass pane when the latter is mounted on the vehicle.

25-3.9.1.4 This test shall be deemed to have given a satisfactory result if the following conditions are fulfilled.

25-3.9.1.4.1 The sample breaks displaying numerous circular cracks centred approximately on the point of impact, the cracks nearest to the point of impact being not more than 80 mm from it;

25-3.9.1.4.2 The layers of glass shall remain adhering to the plastics-material interlayer. One or more partial separation from the interlayer with a distance of less than 4 mm in breadth, on either side of the crack, is permitted outside a circle of 60 mm in diameter centred on the point of impact.

25-3.9.1.4.3 On the impact side:

25-3.9.1.4.3.1 The interlayer must not be laid bare over an area of more than 20 cm^2.

25-3.9.1.4.3.2 A tear in the interlayer up to a length of 35 mm is allowed.

25-3.9.1.5 All the tests give satisfactory results

25-3.9.2 For rigid plastic panes, rigid plastic multiple glazed units, laminated rigid plastic panes, rigid plastic windscreens and Laminated rigid plastic windscreens

25-3.9.2.1 Test pieces：Six flat test pieces (1,170 + 0/-2 mm) x (570 + 0/-2 mm) or six complete parts shall be subjected to testing.

25-3.9.2.2 The test piece shall be kept at a constant temperature of 20 ± 5℃ for at least four hours immediately preceding the test.

25-3.9.2.3 The total mass of the headform shall be 10 (±0.2) kg, and dropping the ball freely from a height or giving the ball a velocity equivalent to that obtained by the free ball. The weight shall strike the test piece within 40mm of the geometric centre on that face which represents the inward face of the safety-glass pane when the latter is mounted on the vehicle.

25-3.9.2.3.1 For laminated rigid plastic panes, rigid plastic panes and rigid plastic multiple glazed units tests on a complete panes drop height

25-3.9.2.3.1.1 For forward facing panes situated forward to an occupant and which have impact probability the drop height shall be 3 m. The HIC value shall also be measured.(used only for a drop height of less than or equal to 1.5 m)

25-3.9.2.3.1.2 For side windows, back windows with limited impact possibilities and sunroofs the drop height shall be 1.5 m. The HIC value shall be measured.

25-3.9.2.3.2 For rigid plastic windscreens and laminated rigid plastic windscreens tests on a complete windscreens, the drop height shall be 3 m. The HIC value is also to be measured.

25-3.9.2.4 The test shall be deemed to have given a satisfactory result if the following conditions are fulfilled:

25-3.9.2.4.1 The test piece or sample is not penetrated nor shall it break into fully separate large pieces.

25-3.9.2.4.2 The HIC value is less than 1,000.

25-3.9.2.4.3 All the tests give satisfactory results.

25-3.10 Test of resistance to abrasion:

25-3.10.1 Test pieces: three pieces of squares of side 100 mm.

25-3.10.2 The methods of haze calculation

Immediately place the test piece against the entrance port of the integrating sphere. The angle between the normal (perpendicular) to the surface of the test piece and the axis of the light beam shall not exceed 8 degrees .

Take four readings as indicated in the following table:

Reading	With test piece	With light-trap	With reflectance standard	Quantity represented
T_1	No	No	Yes	Incident light
T_2	Yes	No	Yes	Total light transmitted by test-piece
T_3	No	Yes	No	Light scattered by instrument
T_4	Yes	Yes	No	Light scattered by instrument and test piece

Repeat readings for T1, T2, T3, and T4 with other specified positions of the test piece to determine uniformity.

Calculate the total transmittance Tt = T2/T1.

Calculate the total transmittance Td as follows:

$$T_d = \frac{T_4 - T_3(T_2 / T_1)}{T_1 - T_3}$$

Calculate the percentage haze, or light, or both, scattered, as follows:
Haze, or light, or both, scattered,

$$= \frac{T_d}{T_t} \times 100\%$$

Measure the initial haze of the test piece at a minimum of four equally-spaced points in the unabraded area in accordance with the formula above. Average the results for each test piece. In lieu of the four measurements, an average value may be obtained by rotating the piece uniformly at 3 rev/sec or more.

25-3.10.3 Condition the test pieces for a minimum time of 48 hours at 20 +/- 5 degrees C and 60 +/- 20 per cent relative humidity.

25-3.10.4 The abrasion test shall be carried out on that surface of the test piece which represents the outside face of the laminated-glass pane when the latter is mounted on the vehicle. Abrading instrument consists of a horizontal turntable, which revolves counter-clockwise at 65 to 75 rev/min, and two weighted parallel arms each carrying a special abrasive wheel freely rotating; each wheel rests on the test specimen under the pressure exerted by a mass of 500 g, the test being continued for 1000 cycles（Rigid plastic glazings and rigid plastic double glazed units can be declared as M by applicant then it can be reduced to 500 times ）. and measure the haze once again. if coated on the inner face with a layer of plastics material(e.g. safety glazing faced with plastics material(on the inside)), the plastics coating shall be subjected to a test for 100 cycles and measure the haze once again.

25-3.10.4.1 For glass-plastics windscreens and glass-plastics panes , test of resistance to abrasion on the outer face, the test being continued for 1,000 cycles ; test of resistance to abrasion on the inner face, the plastics coating shall be subjected to a test for 100

cycles and measure the haze once again.

25-3.10.5 The wheels shall have a hardness of 72 ± 5 IRHD (International Rubber Hardness).

25-3.10.6 Outer surface, the light scatter as a result of abrasion of the test piece does not exceed 2%. In the case of glazing of class M, the abrasion test shall be considered to have given a satisfactory result if the total light scatter after abrasion does not exceed 10 per cent after 500 cycles on the outer surface of the test sample and 4 per cent after 100 cycles on the inner surface of the test sample.

25-3.10.7 In the case of glazing of declared as L by applicant , for the abrasion on the outer surface of the test sample, either the Taber test or as an equivalent alternative the package of Sand drop test, Carwash test and Wiper test shall apply as described in paragraphs 25-3.18, 25-3.19 and 25-3.20.

25-3.10.8 For laminated rigid plastic panes shall be subjected to testing ,as follows：

25-3.10.8.1 In the case of glazing of declared as L by applicant, the Taber abrasion test shall be considered to have given a satisfactory result if the increase of haze after abrasion does not exceed 2 per cent after 1,000 cycles on the outer surface of the test sample and 4 per cent after 100 cycles on the inner surface of the test sample

25-3.10.8.2 In the case of glazing of declared as M by applicant, the Taber abrasion test shall be considered to have given a satisfactory result if the increase of haze after abrasion does not exceed 10 percent after 500 cycles on the outer surface of the test sample and 4 per cent after 100 cycles on the inner surface of the test sample.

25-3.10.8.3 For sun roofs no abrasion test is required.

25-3.10.8.4 All the tests give satisfactory results.

25-3.10.9 For rigid plastic windscreens and laminated rigid plastic windscreens shall be subjected to testing ,as follows：

25-3.10.9.1 The test is performed for 1,000 cycles to measure abrasion of the surface of the product. The safety glazing shall be considered satisfactory with respect to abrasion resistance if the increase of haze as a result of abrasion of the test piece does not

exceed 2 per cent.

25-3.10.9.2 All the tests give a satisfactory result.

25-3.11 Test of resistance to high temperature:

25-3.11.1 Test pieces: three samples or three square test pieces of at least 300 x 300 mm.

25-3.11.2 Heat test pieces to 100 deg. C +0 deg. C / -2 deg. C. Maintain this temperature for a period of two hours, then allow the test pieces to cool to room temperature. The test shall be carried out in an oven if the boiling water temperature is outside the specified tolerance.

25-3.11.3 The test for resistance to high temperature shall be considered to give a positive result if bubbles or other defects are not formed more than 15 mm from an uncut edge or 25 mm from a cut edge of the test piece or sample or more than 10 mm away of any cracks which may occur during the test.

25-3.11.4 A set of test pieces or samples submitted for approval shall be considered satisfactory from the point of view of the test for resistance to high temperature if all the tests have given a satisfactory result.

25-3.12 Resistance-to-radiation test:

25-3.12.1 Test pieces: three test pieces, with size of 76 mm x 300 mm.

25-3.12.2 Maintain the temperature of the test pieces at 45 ± 5℃ throughout the test. That face of each test piece which would constitute a glazed exterior part of the vehicle shall face the lamp. place the test pieces in the test apparatus 230 mm from and parallel lengthwise to the lamp axis (750 ± 50 W quartz mercury lamp or equivalent one) and the exposure time to UV shall be 100 hours.

25-3.12.3 The total light transmittance does not fall below 95 % of the original value before irradiation and in any event does not fall below 70 % in the case of windscreens and other glazing located in a position requisite for driving visibility.

25-3.12.4 For laminated rigid plastic panes and laminated rigid plastic windscreens, the test piece or sample may however show a slight coloration after irradiation when examined against a white background, but no other defect may be apparent. A set of test pieces or

samples submitted for approval shall be considered satisfactory from the point of view of the resistance-to-radiation test if one of the following conditions is fulfilled:

25-3.12.5 All the tests give a satisfactory result.

25-3.13 Resistance-to-humidity test:

25-3.13.1 For laminated-glass panes, laminated-glass windscreens ,safety glazing faced with plastics material(on the inside), glass-plastics windscreens and glass-plastics panes of test pieces: Three square test pieces of 300 x 300 mm (In the case of rigid plastic panes and rigid plastic multiple glazed units, laminated rigid plastic panes and laminated rigid plastic windscreens, the number of samples shall be ten).

25-3.13.2 Keep test pieces in a vertical position for two weeks in a closed container in which the temperature is maintained at 50 +/- 2 ℃ and the relative humidity at 95 +/- 4%.

25-3.13.3 Test pieces shall be comply with following regulations:

25-3.13.3.1 For laminated glass, laminated-glass windscreens ,rigid plastic panes, rigid plastic multiple glazed units, safety glazing faced with plastics material(on the inside), glass-plastics windscreens and glass-plastics panes:

25-3.13.3.1.1 Safety glazing shall be deemed to be satisfactory from the point of view of resistance to humidity if no significant change is observed more than 10 mm from the uncut edges and more than 15 mm from the cut edges after ordinary and treated laminated glass panes have been maintained for two hours in the ambient atmosphere, and plastics-faced and glass-plastics panes have been maintained for 48 hours in the ambient atmosphere.

25-3.13.3.1.2 A set of test pieces or samples submitted for approval shall be considered satisfactory from the point of view of the test for resistance to humidity if all the tests have given a satisfactory result.

25-3.13.3.2 For rigid plastic windscreens, laminated rigid plastic panes and laminated rigid plastic windscreens

25-3.13.3.2.1 No visible decompositions like bubbles or milkiness occur on any sample,

25-3.13.3.2.2 and if the light transmittance measured does not fall to less than 95% of the pre-test value and additionally to no less than 70% for any window required for driver visibility.

25-3.13.3.2.3 After testing the test pieces shall be stored for at least 48 hours at a temperature of 23 deg. C +/- 2 deg. C and a relative humidity of 50 per cent +/- 5 per cent, and then subjected to the 227 g ball drop test,(under ambient temperature and height of drop of 8.5 m).

25-3.14 Light-transmission test

25-3.14.1 Test piece: Four test piece for the complete product. For the laminated-glass windscreens of M1 vehicles the test shall be carried out in test area B (see figure 2, 3), For the laminated -glass windscreens of N1 vehicles, the manufacturer may request that the same test may be carried out either in test area B, or in the zone I (see Fig 5), for windscreens of other categories of vehicles, the test shall be carried out in the zone Ⅰ; For the glass panes other than windscreen, the test piece of laminated-glass pane and the test piece of toughened -glass pane are both cut from the complete products.

25-3.14.1.1 For glass-plastics panes shall apply to glass glazing or parts of glass panes located at places which are essential to the driver's vision.

25-3.14.2 The sensitivity of the measuring system shall be adjusted in such a way that the instrument indicating the response of the receiver indicates 100 divisions when the safety-glass pane is not inserted in the light path. Insert the safety-glass pane between the diaphragm and the receiver and adjust its orientation in such a way that the angle of incidence of the light beam is equal to 0 +/- 5 degrees. The regular transmittance should be measured on the safety-glass pane and for every point measured the number of divisions, n, shown on the indicating instrument, shall be read.

25-3.14.3 The regular transmittance zeta is equal to n/100. Before 2010/01/01, the regular transmittance measured in the case of windscreens shall not be less than 75 % and, in the case of windows other than windscreens shall not be less than 70 %. From 2010/01/01, the regular transmittance measured of windscreens or other than windscreens shall not be less than 70 %..In the case

of glass panes in places not essential for the driver's vision (e.g. sun roofs) the regular light transmittance of the glass pane may be less than 70 %. Glass panes with a regular light transmittance less than 70 % shall be appropriately marked.

25-3.14.4 All the tests give a satisfactory result.

25-3.15 Optical distortion test

25-3.15.1 Test pieces: four samples (complete product) shall be submitted for testing.

25-3.15.2 The windscreen shall be mounted at the same angle of inclination as on the vehicle, at a distance of 4 m from the light source, and measure the angular deviation delta alpha measured between two points M and M' on the surface of the glass pane, on the display screen 6-8 m away from the light source, see figure 6.

25-3.15.3 The maximum value of optical distortion:

For vehicle symbol category N1, the manufacturer may request that the same test may be carried out either in test area A/ B, or in the zone Ⅰ.

25-3.15.3.1 For vehicle symbol categories M1 and N1 in the extended test area A (an area extended to the median plane of the vehicle, as indicated in Fig 1, Fig 1-1 ,and in the corresponding part of the windscreen symmetrical to it about the longitudinal medium plane of the vehicle): 2' of arc.

25-3.15.3.2 For vehicle symbol categories M1 and N1 in the reduced test area B (see Fig 2 and 3): 6 ' of arc.

25-3.15.3.3 For vehicles of categories M and N except for M1, in zone I (see Fig 5): 2 ' of arc.

25-3.16 Secondary-image-separation test

25-3.16.1 Test pieces: four complete samples shall be submitted for testing.

25-3.16.2 The distance between the test piece and the light box is more than 7 m. Mount the test piece at the specified rake angle. Determine whether the secondary image of the spots shifts beyond the point of tangency with the inside edge of the circle..

25-3.16.3 The maximum values of the separation of the primary and secondary images:

For vehicle symbol category N1, the manufacturer may request that the same test may be carried out either in test area A/ B, or in the zone Ⅰ.

25-3.16.3.1 For vehicle symbol category M1 and N1 in the extended test area A (an area extended to the median plane of the vehicle, as indicated in Fig 1,Fig 1-1, and in the corresponding part of the windscreen symmetrical to it about the longitudinal medium plane of the vehicle): 15’ of arc.

25-3.16.3.2 For vehicle symbol category M1 and N1 in the reduced test area B (see Fig 2 and 3): 25 ’ of arc.

25-3.16.3.3 For vehicles of categories M and N except for M1, in zone I (see Fig 5): 15 ’ of arc.

25-3.17 Flexibility test and fold test

25-3.17.1 Test pieces: a rectangular flat sample 300 mm long and 25 mm wide and one piece shall be tested.

25-3.17.2 25 mm wide is cut out and horizontally clamped into a clamping device in such a way that 275 mm of the length of test pieces freely extend over the holding device. (Temperature: 20 degrees C +/- 2 degrees C , relative Humidity: 60 % +/- 5 %)

25-3.17.3 Test pieces shall comply with following regulations:

25-3.17.3.1 Rigid plastic: Sixty seconds after removal of this support the vertical deviation of the free end must be less than 50 mm.

25-3.17.3.2 Flexible plastic: Sixty seconds after removal of this support the vertical deviation be more than 50 mm, and 10 seconds after a 180 degrees - folding the material shall not show any fracture-like damages at the point of buckling.

25-3.18 Sand drop test

25-3.18.1 Apparatus：The sand drop test equipment shall consist essentially of that illustrated in Figure 8. The gravity tube consists of three separate rigid polyvinylchloride tubes (PVC hard) of the same diameter, with two polyamide sieves mounted in between. The sieves should have a mesh size of 1.6 mm. The speed of the turntable shall be 250 +/- 10 rev/min.

25-3.18.2 Abrasive material：Natural quartz sand of grain size of 0.50/0.70 mm, with no oversize, obtained by sieving on wire sieves complying with ISO 565 with a mesh size of 0.50 mm and 0.70 mm. The sand may be used up to 10 times.

25-3.18.3 Test pieces：Three square flat pieces 50 mm x 50 mm of each type shall be taken from the flattest part of the windscreen in the area (windscreen in the area test area A). The test shall be carried out on the face corresponding to the outside of the windscreen. The test piece shall be conditioned to (23 +/- 2) deg. C and (50 +/- 5) per cent relative humidity (rH) for minimum 48 hours and subjected to testing at ambient temperature.

25-3.18.4 Test procedure：Three kilograms of 0.50/0.70 mm grain size quartz sand shall drop through a gravity tube from a height of 1.650 mm onto the sample to be tested. The test piece and, if necessary, a control-piece shall be mounted on a turntable, the axis of which is a 45 deg. angle to the direction of the sand. The test pieces shall be mounted on the turntable in such a way that the area to be measured does not extend beyond the turntable. One cycle of 3 kg sand drop shall be performed while the turntable is rotating. The surface of the test piece shall be washed in water containing l per cent detergent and rinsed with distilled or demineralized water, then carefully dried with a grease-free and dust-free linen cloth. Immediately after drying and before abrasion, the initial haze shall be measured, and the haze shall be measured again immediately after abrasion. A haze meter, according to paragraphs 25-3.10.2 of this Regulation, shall be used for measuring the haze.

25-3.18.5 Interpretation of results：The safety glazing shall be considered satisfactory if the increase of haze as a result of abrasion of the test piece does not exceed 5 per cent.

25-3.18.6 All the tests give a satisfactory result.

25-3.19 Car wash test

25-3.19.1 Apparatus：

The apparatus shall comprise at least the following individual components:

25-3.19.1.1 Washing brush：

diameter (1,000 +/- 40) mm

width Minimum 300 mm

rotation speed (127 +/- 5) rev/min

brush rotation rotates in the opposite direction relative to the direction of travel of the test panel holder

material polyethylene

bristle profile x-shaped, spliced

bristle thickness (0.8 +/- 0.2) mm

bristle length (440 +/- 20) mm visible

penetration depth (100 +/- 20) mm

(see Figure 9)

The state of the brushes shall be regularly controlled. At least one monitoring of the total amount of operating hours in use for the brush and an automatic replacement of the brush shall be conducted as soon as 30 operating hours are reached (30 hours equates around 300 test runs since one test takes around 6 minutes). The amount of operating hours shall be reported with the haze increase result of the sample.

25-3.19.1.2 Spray nozzle：

number 2 (spray alternatively and against the direction of travel of the test panel holder)

material stainless steel

spread of jet 65 deg.

water flow rate (2.2 +/- 0.1) l/min. at (300 +/- 50) kPa

The two nozzles shall spray alternately and against the direction of travel of the test panel holder. They shall produce the specified spray pattern (see instrument calibration in Figure 10).

25-3.19.1.3 Test panel holder

feed speed (5 +/- 0.2) m/min.

pattern of movement if the brush is rotating clockwise, the right nozzle is spraying and the test panel holder travels from the left side to the right side (and vice versa)

25-3.19.2 Spray suspension

Prepare a suspension consisting of (1.5 +/- 0.05 g) of silica powder (silica micro-powder having a mean particle size of 24

micrometres) per litre of tap water in a container, stirring vigorously. The water temperature shall be between 15 deg. C and 30 deg. C.The suspension shall be stirred continuously during the test procedure in such a way that the silica powder does not settle on the bottom of the container.

25-3.19.3 Test samples

The size of the samples shall be 50 mm x 100 mm.

Prior to testing the samples shall be conditioned for at least 48 hours at an ambient temperature (23 deg. C +/- 2 deg. C) and an ambient relative humidity (50 per cent +/-5 per cent).

25-3.19.4 Procedure

25-3.19.4.1 Prearrangements

25-3.19.4.1.1 The abrasion test shall be carried out at room temperature and only on the outside surface of the plastic safety glazing material.

25-3.19.4.1.2 Check the state of the polyethylene brushes as described in paragraph 25-3.19.1.1 and replace them if they have reached 30 operating hours in total.

25-3.19.4.1.3 Do the instrument calibration as follows: Set up the equipment as shown in figure 10. Fill with washing suspension (see paragraph 25-3.19.2 and wet the brush sufficiently. Determine the flow rate of the water, (2.2 +/- 0.1) l/min., by measurement and adjust by altering the pressure, (300 +/- 50) kPa. Check the spray pattern of the nozzles (see Figure 11) If the spray pattern cannot be achieved or if the pressure regulation exceeds the tolerances, check, and if necessary replace, the nozzles.

25-3.19.4.2 Test

25-3.19.4.2.1 Affix the samples with the outside surface face up onto a supporting plate by using a double-faced adhesive tape (Sample positioning on the test holder as shown in Figure12).

25-3.19.4.2.2 An area of at least 50 mm at the start and finish of the test panel holder and of at least 30 mm edgewise to the direction of travel of the test panel holder may not be used as testing area for the test specimen.

25-3.19.4.2.3 Carry out 10 washing operations (10 double passes) using the to-and-fro pattern of movement. Rinse the washed test samples after removing the adhesive tape with cold water, and then clean it with a suitable solvent, e.g. Isopropyl alcohol (IPA), using soft, non-scratching paper tissues and wiping in the direction of the scratches. Finally, leave for 30 minutes to dry off. In case of any inhomogeneous surface appearance of the sample repeat this cleaning process to ensure complete removal of any residue

25-3.19.4.2.4 After drying, take the final readings of haze, as described in paragraph 25-3.10.2 of this Regulation, of the test specimens across the direction of scratching.

25-3.19.4.3 Expression of the results

Subtract the average initial haze from the average total light scattered, the difference representing the light scatter resulting from washing the test specimen. Report this difference for 10 washing operations (10 double strokes) for the outside surface of the test samples.

25-3.19.5 Interpretation of results

The safety glazing shall be considered satisfactory if the increase of haze as a result of abrasion of the test piece does not exceed 2 per cent.

25-3.19.6 All the tests give a satisfactory result.

25-3.20 Wiper laboratory test

Determination of whether a rigid plastic material intended to be used as safety glazing in locations requisite for driver visibility and additionally equipped with a system suitable to wipe the surface has a certain minimum resistance against the action of a wiper including dirt at ambient temperature.

25-3.20.1 Apparatus

The apparatus1 is shown schematically in the following figures and includes at least the following individual components:

25-3.20.1.1 A base apparatus with two pillars providing a back and forth linear motion with 37 +/- 2 cycles per minute and the possibility to adjust the stroke length (half a wipe cycles) to 130 +/- 5 mm, which leads to an average wipe speed of 160 +/- 15 mm/s (speed range from 0 (reversal point) to maximal speed (between the two reversal points)),

25-3.20.1.2 The apparatus1 is shown schematically in the following figures and includes at least the following individual components:

A wiper carriage assembly (see 1 in Figures 13 and 14) having a beam which spans across the width of the base apparatus and can be mounted at its ends to the pillars, furthermore this carriage assembly has two self-supporting arms (see 2 in Figures 13 and 14) where a wiper holder can be attached (the distance between the sample surface and bearing of self-supporting arm at the carriage assembly is 100 to 105 mm),

25-3.20.1.3 A wiper holder2 (see 3 in Figure 13) suitable to attach a normal wiper blade (see 4 in Figure 13) and adjusted to provide a load of 15 +/- 0.5 g/cm (the weight of the wiper blade and its holder together with the wiper blade width determine the wiper load in g/cm),

25-3.20.1.4 Two sample boxes3 (see 5 in Figures 13 and 14) made out of inert, material in the interior dimension of 200 mm x 120 mm (50 mm height) used to be filled with the aqueous suspension and having a hole at the bottom4 where the test sample can be inserted and therefore used as a test sample holder,

25-3.20.1.5 Different spacer plaques (see 7 in Figure 13) (e.g. made out of the sample box material) in the dimension of the sample but with different thicknesses used to compensate different test sample thicknesses (it is necessary that the bottom surface of the sample box and the sample surface to be tested are on the same height); furthermore care has to be taken to avoid scratching the test sample placed on top of the spacer (e.g. by placing a ultrathin soft film on the surface of the spacer),

25-3.20.1.6 A stainless steel tray (see 11 in Figures 13 and 14),

25-3.20.1.7 A wipe cycle counter.

25-3.20.2 Wiper blade

The wiper used to test the resistance of rigid plastic safety glazing against wiping with dirt shall be either:

(a) A normal glass windscreen wiper blade based on chloroprene type rubber (CR grade), chlorinated and with a graphite based anti-friction coating on the surface6 in a width of 80 mm or,

(b) A commercially available specific device which is adjusted to the surface characteristics of the rigid plastic glazing and actually intended to be used in the vehicle (e.g. a hydrophobic wiper blade) also in a width of 80 mm. The geometric and chemical characteristics and type of the specific device used for the typ approval test shall be described in the test report. In case the specific device has a significantly different cross profile it might be necessary to adapt the wiper blade holder respectively. A new blade shall be used for every test sample. The wiper blade shall be fixed into the holder as shown below(see 15).

25-3.20.3 Sample

The size of the absolutely flat test samples shall be 150 mm x 100 mm (slightly larger than the wipe area of 130 mm stroke length and 80 mm wiper blade length). The thickness of the test sample shall correspond to the thickness of the rigid plastic glazing part.

25-3.20.4 Aqueous suspension

The aqueous suspension shall contain:

(a) 195 +/- 1 g water (with a hardness of less than 205 mg/l after evaporation) (97.5 wt.-per cent)

(b) 5 +/- 0.2 g so called ISO test dust A4 (according to ISO 12103-1)7 (2.5 wt.-per cent)

(c) And shall be freshly prepared at room temperature and stirred before use. This amount of aqueous suspension is sufficient for testing one sample and leads to a filling level of around 10 mm in the sample box. A new aqueous suspension shall be used for every test.

25-3.20.5 Procedure

25-3.20.5.1 Sample pre-treatment

Before testing the samples shall be cleaned using a soft cloth soaked with iso-propanol followed by deionized water and drying. After cleaning the samples shall be conditioned for at least 24 hours at 23 deg. C +/- 2 deg. C and (50 +/- 5) per cent relative humidity.

The initial haze value according to paragraph 25-3.10.2 of this Regulation of the test sample is measured at 9 measurement points across the sample (see 4 in Figure 18).

25-3.20.5.2 Test equipment pre-check

25-3.20.5.2.1 Before the equipment is used for testing samples the back and forth linear motion of the pillars of the base apparatus shall be checked for being uniform without any disturbance like getting stuck or starting to vibrate.

25-3.20.5.2.2 Build up the whole instrument including tray, wiper carriage assembly, wiper blade holders and new wiper blades but without sample box and sample (see Figure 16). To do so the two new wiper blades shall be mounted to their respective wiper blade holders and the latter ones shall be fixed to the carriage assembly.

Then align using a spirit level the base plate where later the sample box will be placed and the wiper carriage assembly. Check that the distances of the two bearings of both self-supporting arms at the wiper carriage assembly and at the wiper blade holder are identical.

Furthermore control visually that the wiper blade rest on the base plate uniformly without losing contact to the base plate at any point of the wiper blade.

25-3.20.5.2.3 After this pre-check the wiper carriage assemble with the wiper blade holder and the wiper blade shall be removed from the base instrument to allow built up of the sample boxes.

25-3.20.5.2.4 The test shall be carried out under the following conditions: ambient temperature of 20 deg. C +/- 5 deg. C, atmospheric pressure of 86 kPa to 106 kPa (860 mbar to 1,060 mbar), and relative humidity of (60 +/- 20) per cent.

25-3.20.5.3 Abrasion procedure

25-3.20.5.3.1 With the instrument described above two samples shall be tested in parallel. In case there is only one sample to be tested the second sample box needs to be fitted with a dummy sample.

25-3.20.5.3.2 The sample box shall be placed into the stainless steel tray and fixed using adhesive tape on the two short sides of the box according to see B in Figure 16. It is essential that the position of the box leads to a wiping area in exactly the middle of the sample (see 2 in Figure 16).

A spacer plaque adjusted to the thickness of the test sample so that the test sample surface and the bottom surface of the sample box are on the same height (no visible gap in height between sample and bottom surface of the sample box) shall be placed into the hole in the bottom of the sample box.

25-3.20.5.3.3 The sample shall be placed with the to be tested side facing up (representing the outside surface of the plastic glazing part) into the sample holder of the sample box onto the right spacer plaque (which has a soft masking film on its surface to avoid scratching the test samples backside). An adhesive tape shall be used all around the test sample to fix it into the holder and seal the space between sample edge and sample box (to avoid suspension penetrating underneath the sample). The tape shall be used in such a way that the overlay between tape and sample is at maximum 10 mm or in other words in such a way that the wiping area of the sample (see Figure 18) is free of any adhesive tape.

25-3.20.5.3.4 After fixing the sample the carriage assembly including wiper holders and blades from the pre-check shall be mounted to the pillars of the base apparatus. Thereby, the wiper blades get into contact with their respective samples. The correct load (15 +/- 0.5 g/cm of the wiper blade onto the sample shall be checked using a spring balance.9 Ensure again that the whole equipment (especially test sample, box, and carriage assembly inclusive wiper holder and blade) is aligned by using a spirit level.

25-3.20.5.3.5 A freshly prepared suspension shall be filled into each sample box and then the linear back and forth motion of the wiper blade shall be started.

25-3.20.5.3.6 In order to ensure a homogenous abrading it is necessary to follow the action described below:

25-3.20.5.3.6.1 After half of the test cycle numbers 10,000 cycles the test shall be stopped and the two sample boxes shall be exchanged without turning them (see Figure 17)10; this leads to an exchange for the two simultaneously tested samples regarding their wiper blades and furthermore alters the alignment of the self-supporting arm carrying the blade (from left to right or the other way round).

25-3.20.5.4 Sample treatment after abrasion

25-3.20.5.4.1 When the abrasion test is finished after 20,000 wipe cycles the suspension shall be drained and the abraded test samples shall be removed and cleaned using a multistep process including:

(a) Washing with running water,

(b) Drying,

(c) Wiping with an iso-propanol soaked soft cloth,

(d) Followed by deionized water, and

(e) Drying.

25-3.20.5.4.2 After cleaning the abraded test samples shall be checked for visible chatter marks as this indicates a none uniform movement of the wiper during the abrasion test. In case of visible chatter marks this sample shall be discarded from further investigation and a retest with a new test sample needs to be done.

25-3.20.5.4.3 The samples without chatter marks shall be conditioned for at least 24 hours at 23 deg.C +/- 2 deg. C and (50 +/- 5) per cent relative humidity. The final haze value according to this regulation of the test samples shall be measured within the middle of the samples(area of 75 mm x 60 mm).

The area at the edges of the sample - 20 mm from the long edges and 37.5 mm from the short edges - shall be excluded from the optical measurement. These areas include the reversal point of the wiper blade and the two ends of the wiper blade, where localized different abrasion conditions could exist compared to the middle of the test sample.

25-3.20.5.4.4 Nine measurement points according to Figure 18 below shall be used to determine the delta haze at these points and calculate an average delta haze afterwards.

25-3.20.6 Expression of results

Subtract the initial haze from the final haze for every measurement point, the difference representing the so-called delta haze. Calculate out of these values for the individual measurement points the average delta haze (including standard deviation) resulting from abrasion action of aqueous dirt wiped for 20,000 cycles on the sample surface by a to be reported wiper blade type.

25-3.20.7 Design Drawing of the Wiper Blade Holder, see Figure 19 (Cross-cut view of the wiper blade holder with the support plate (left side) and the clamping plate (right side)),Design Drawing from the Sample Box ,see Figure 20 (Side view of the support plate (left side) and the clamping plate (right side)), see Figure 21(Details regarding the area A in figure 2), see Figure 22(3-D view of the wiper blade holder). see Figure 23 (Bird's-eye view of the box), see Figure 24 (Cross cut view at A), see Figure 25 (3-D view of the box).

25-3.20.8 Interpretation of results

The safety glazing shall be considered satisfactory if the increase of haze as a result of abrasion of the test piece does not exceed 2 per cent.

25-3.20.9 All the tests give a satisfactory result.

25-3.21 Resistance to simulated weathering

25-3.21.1 Test method

25-3.21.1.1 Apparatus

25-3.21.1.1.1 Long arc xenon lamp

The exposure apparatus shall utilize a long arc xenon lamp as the source of irradiation, but other methods giving the required level of ultraviolet radiant exposure shall be allowed. The long arc xenon lamp is advantageous in that it can, when correctly filtered and maintained, yield a spectrum most closely approximating that of natural sunlight. To this end, the quartz xenon burner tube shall be fitted with suitable borosilicate glass optical filter(s). The xenon lamps employed shall be operated, from a suitable 50 or 60 Hz power supply suitable reactance transformers and electrical equipment.

The exposure apparatus shall include equipment necessary for measuring and/or

controlling the following:

(a) Irradiance

(b) Black standard temperature

(c) Water spray

(d) Operating schedule or cycle

The exposure apparatus shall be made from inert materials which do not contaminate the water employed in the test.

Irradiance shall be measured at the surface of the test piece surface and shall be controlled according to the recommendations of the exposure apparatus manufacturer.

Total ultraviolet6 radiant exposure (Joules per square metre) shall be measured or computed and shall be considered the primary measure of test piece exposure.

25-3.21.1.2 Test pieces

The dimensions of the test pieces shall normally be those specified in the appropriate test method for the property or properties to be measured after exposure.

The number of control and test pieces for each test condition or exposure stage shall be determined, in addition to those required for visual evaluations by the number required by the test methods.

It is recommended that visual evaluations be conducted on the largest test pieces tested.

25-3.21.1.2.1 Number of test pieces

Three flat test pieces 130 mm x 40 mm cut from a flat sheet sample shall be subjected to testing.

25-3.21.1.3 Procedure

Measure, according to paragraph 25-3.14 the luminous transmission of the test specimen(s) to be exposed. Measure, according to paragraph 25-3.10, the resistance to abrasion of the surface(s) of the control piece(s). That face of each test pieces, which would represent the surface glazed to the exterior of the road vehicle, shall face the lamp. Other exposure conditions shall be as follows:

25-3.21.1.3.1 The irradiance shall not vary more than +/-10 per cent over the whole test specimen area.

25-3.21.1.3.2 At appropriate intervals, clean lamp filters by washing with detergent and water. Xenon arc filters shall be replaced according to the recommendations of the equipment manufacturer.

25-3.21.1.3.3 The temperature within the exposure apparatus during the dry portion of the cycle shall be controlled by circulation of sufficient air to maintain a constant black standard temperature.

In the xenon arc exposure apparatus, this temperature shall be 70 deg. C +/- 3 deg. C as indicated by a Black standard thermometer or equivalent.

The black panel thermometer shall be mounted in the test specimen rack and readings shall be taken at the point where maximum heat is developed due to light exposure.

25-3.21.1.3.4 The relative humidity within the exposure apparatus shall be controlled at 50 +/- 5 percent during the dry portions of the cycle.

25-3.21.1.3.5 The deionized water used in the spray cycle shall contain less than 1 ppm silicon dioxide solids and shall leave no permanent deposit or residue on the test specimens which would interfere with subsequent measurements.

25-3.21.1.3.6 The pH of the water shall be between 6.0 and 8.0, and the conductivity shall be less than 5 microsiemens.

25-3.21.1.3.7 The temperature of the water in the line where it enters the exposure apparatus shall be the ambient water temperature.

25-3.21.1.3.8 The water shall strike the test specimens in the form of a fine spray in sufficient volume to wet the test specimens uniformly, immediately upon impact.

Water spray will be directed only against the test specimen surface facing the light source. No recirculation of the spray water or immersion of the test specimens in the water shall be permitted.

25-3.21.1.3.9 The test specimens shall be rotated about the arc in order to provide uniform distribution of the light. All positions in the exposure apparatus shall be filled with test specimens or surrogates to ensure that a uniform temperature distribution is maintained. Test specimens shall be held in frames with backs exposed to the cabinet environment.

However, reflections from cabinet walls shall not be permitted to strike the back surface of specimens. If necessary, samples may be backed to block such reflections so long as free circulation of air at the specimen surface is not impeded.

25-3.21.1.3.10 The exposure apparatus shall be operated to provide continuous light and intermittent water spray in 2 h cycles. Each 2 h cycle shall be divided into periods during which the test specimens are exposed to light without water spray for 102 minutes and to light with water spray for 18 minutes.

25-3.21.1.4 Evaluation

After exposure, the test pieces may be cleaned, if necessary, by a practice recommended by their manufacturer to remove any residues present.

Evaluate the exposed test pieces visually with respect to the following properties:

(a) Bubbles

(b) Colour

(c) Haze

(d) Noticeable decomposition

Measure the luminous transmission of the exposed test pieces.

25-3.21.1.5 Expression of results

Report visual evaluations of exposed test pieces, comparing the appearance of each with that of the unexposed control.

The regular light transmittance measured shall not differ from the original test on unexposed samples by more than 5 per cent and shall not fall below:

70 per cent in the case of a windscreen and other glazing that is located in a position requisite for driving visibility.

25-3.22 Test of resistance to temperature changes

25-3.22.1 Test method

Two test pieces 300 mm x 300 mm shall be placed in an enclosure at a temperature of -40 deg. C +/- 5 deg. C for a period of 6 hours; they shall then be placed in the open air at a temperature of 23 deg. C +/- 2 deg. C for one hour or until temperature equilibrium has been reached by the test pieces. These shall then be placed in circulating air at a temperature of 72 deg. C +/- 2 deg. C for 3 hours. After being placed again in the open air at 23 deg. C +/- 2 deg. C and cooled to that temperature, the test pieces shall be examined.

25-3.22.2 Indices of difficulty of secondary characteristics

	Colourless	Tinted
Colouring of the interlayer or of the plastics coating	1	2

The other secondary characteristics are not involved.

25-3.22.3 Interpretation of results

The test for resistance to temperature changes shall be considered to have given a satisfactory result if the test pieces do not show any evidence of cracking, clouding, separation of layers or other apparent deterioration.

25-3.23 Burning behaviour (fire-resistance) test

25-3.23.1 Purpose and scope of application

This method enables the horizontal burning rate of materials used in the passenger compartment of motor vehicles (for example, private passenger cars, lorries (trucks), estate cars, motor coaches) after exposure to a small flame to be determined.

This method permits testing of materials and components of a vehicle's interior equipment individually or in combination up to a thickness of 13 mm. It is used to judge the uniformity of production lots of such materials with respect to their burning behaviour.

Because of the many differences between the real-world situation (application and orientation within a vehicle, conditions of use, ignition source, etc.) and the precise test conditions prescribed herein, this method cannot be considered as suitable for evaluation of all true in-vehicle burning characteristics.

25-3.23.2 Definitions

25-3.23.2.1 Burning rate: The quotient of the burnt distance measured according to this method and the time taken to burn that distance. It is expressed in millimetres per minute.

25-3.23.2.2 Composite material: A material composed of several layers of similar or different materials intimately held together at their surfaces by cementing, bonding, cladding, welding, etc.

When different materials are connected together intermittently (for example, by sewing, high-frequency-welding, riveting), then in order to permit the preparation of individual samples in accordance with paragraph 23-3 23.5. below such materials shall not be considered as composite materials.

25-3.23.2.3 Exposed side: The side which is facing towards the passenger compartment when the material is mounted in the vehicle.

25-3.23.3 Principle

A sample is held horizontally in a U-shaped holder and is exposed to the action of a defined low-energy flame for 15 seconds in a combustion chamber, the flame acting on the free end of the sample. The test determines whether and when the flame is extinguished or the time which the flame requires to proceed over a measured distance.

25-3.23.4 Apparatus

25-3.23.4.1 Combustion chamber (Figure 26), preferably of stainless steel, having the dimensions given in Figure 27.

The front of the chamber contains a flame-resistant observation window, which may cover the entire front and which can be constructed as an access panel.

The bottom of the chamber has vent holes, and the top has a vent slot all around. The combustion chamber is placed on four feet, 10 mm high. The chamber may have a hole at one end for the introduction of the sample holder containing the sample; in the opposite end, a hole is provided for the gas-supply line. Melted material is caught in a pan (see Figure 28) which is placed on the bottom of the chamber between vent holes without covering any vent hole area.

25-3.23.4.2 Sample holder, consisting of two U-shaped metal plates or frames of corrosion-proof material. Dimensions are given in Figure 29.

The lower plate is equipped with pins and the upper one with corresponding holes, in order to ensure a consistent holding of the sample. The pins also serve as measuring points at the beginning and end of the burning distance.

A support shall be provided in the form of heat-resistant wires 0.25 mm in diameter spanning the frame at 25-mm intervals over the bottom U-shaped frame (see Figure 30).

The plane of the lower side of samples shall be 178 mm above the floor plate. The distance of the front edge of the sample holder from the end of the chamber shall be 22 mm; the distance of the longitudinal sides of the sample holder from the sides of the chamber shall be 50 mm (all inside dimensions). (See Figures 26 and 27).

25-3.23.4.3 Gas burner

The small ignition source is provided by a Bunsen burner having an inside diameter of 9.5 mm. It is so located in the test cabinet that the centre of its nozzle is 19 mm below the centre of the bottom edge of the open end of the sample (see Figure 27).

25-3.23.4.4 Test gas

The gas supplied to the burner shall have a calorific value of about 38 MJ/m3 (for example natural gas).

25-3.23.4.5 Metal comb, at least 110 mm in length, with seven or eight smooth rounded teeth per 25 mm.

25-3.23.4.6 Stop-watch, accurate to 0.5 sec.

25-3.23.4.7 Fume cupboard

The combustion chamber may be placed in a fume-cupboard assembly provided that the latter's internal volume is at least 20 times, but not more than 110 times, greater than th volume of the combustion chamber and provided that no single height, width, or length dimension of the fume cupboard is greater than 2.5 times either of the other two dimensions.

Before the test, the vertical velocity of the air through the fume cupboard shall be measured 100 mm forward of and to the rear of the ultimate site of the combustion chamber. It shall be between 0.10 and 0.30 m/s in order to avoid possible discomfort to the operator from combustion products. It is possible to use a fume cupboard with natural ventilation and an appropriate air velocity.

25-3.23.5 Samples

25-3.23.5.1 Shape and dimensions

The shape and dimensions of samples are given in Figure 31. The thickness of the sample corresponds to the thickness of the product to be tested. It shall not be more than 13 mm. When sample-taking so permits, the sample shall have a constant section over its entire length. When the shape and dimensions of a product do not permit taking a sample of the given size, the following minimum dimensions shall be observed:

(a) For samples having a width of 3 to 60 mm, the length shall be 356 mm. In this case the material is tested over the product's width;

(b) For samples having a width of 60 to 100 mm, the length shall be at least 138 mm.

In this case the potential burning distance corresponds to the length of the sample, the measurement starting at the first measuring point;

(c) Samples less than 60 mm wide and les than 356 mm long, and samples 60 to 100 mm wide and less than 138 mm long, cannot be tested according to the present method, nor can samples less than 3 mm wide.

25-3.23.5.2 Sampling

At least five samples shall be taken from the material under test. In materials having burning rates differing according to the direction of the material (this being established by preliminary tests) the five (or more) samples shall be taken and be placed in the test apparatus in such a way that the highest burning rate will be measured.

When the material is supplied in set widths, a length of at least 500 mm covering the entire width shall be cut. From the piece so cut, the samples shall be taken at not less than 100 mm from the edge of the material and at points equidistant from each other.

Samples shall be taken in the same way from finished products when the shape of the product so permits. If the thickness of the product is over 13 mm it shall be reduced to 13 mm by a mechanical process applied to the side which does not face the passenger compartment.

Composite materials shall be tested as if they were homogeneous.

In the case of materials comprising superimposed layers of different composition which are not composite materials, all the layers of material included within a depth of 13 mm from the surface facing towards the passenger compartment shall be tested individually.

25-3.23.5.3 Conditioning

The samples shall be conditioned for at least 24 hours, but not more than 7 days, at a temperature of 23 deg. C +/- 2 deg. C and a relative humidity of 50 +/- 5 per cent, and shall be maintained under these conditions until immediately prior to testing.

25-3.23.6 Procedure

25-3.23.6.1 Place samples with napped or tufted surfaces on a flat surface, and comb twice against the nap using the comb (paragraph 25-3.23.4.5).

25-3.23.6.2 So place the sample in the sample holder (paragraph 25-3.23.4.2) that the exposed side faces downwards, towards the flame.

25-3.23.6.3 Adjust the gas flame to a height of 38 mm using the mark in the chamber, the air intake of the burner being closed. The flame shall burn for at least one minute, for stabilization, before the first test is started.

25-3.23.6.4 Push the sample holder into the combustion chamber so that the end of the sample is exposed to the flame, and after 15 seconds cut off the gas flow.

25-3.23.6.5 Measurement of burning time starts at the moment when the foot of the flame passes the first measuring point. Observe the flame propagation on the side (upper or lower) which burns faster.

25-3.23.6.6 Measurement of burning time is completed when the flame has come to the last measuring point or when the flame is extinguished before reaching that point. If the flame does not reach the last measuring point, measure the burnt distance up to the point where the flame was extinguished. Burnt distance is the part of the sample destroyed, on the surface or inside, by burning.

25-3.23.6.7 If the sample does not ignite or does not continue burning after the burner has been extinguished, or the flame goes out before reaching the first measuring point, so that no burning time is measured, note in the test report that the burning rate is 0 mm/min.

25-3.23.6.8 When running a series of tests or performing repeat tests, make sure before starting a test that the temperature of the combustion chamber and sample holder does not exceed 30 deg. C.

25-3.23.7 Calculation

The burning rate B, in millimetres per minute, is given by the formula:

B = s/t x 60;

where:

s is the burnt distance, in millimetres,

t is the time, in seconds, taken to burn the distance s.

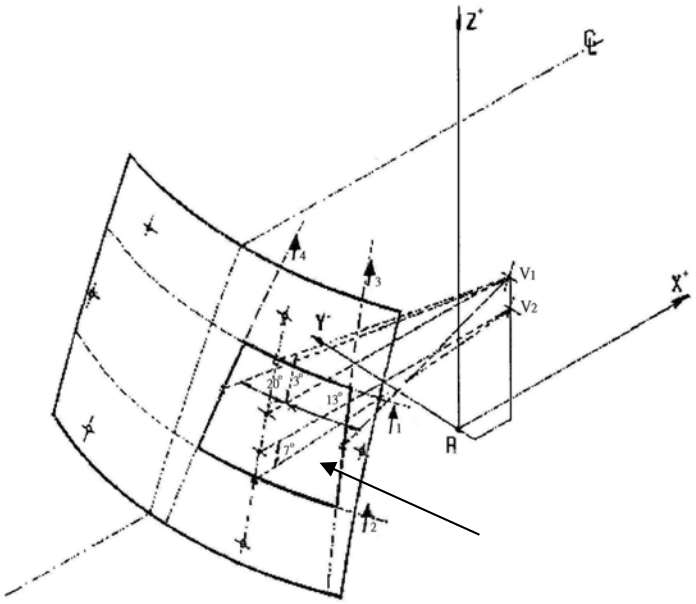
25-3.23.8 Indices of difficulty of the secondary characteristics

No secondary characteristics are involved.

25-3.23.9 Interpretation of results

25-3.23.9.1 Safety glazing faced with plastics material (paragraph 25-3.2.4 of this Regulation) and glassplastics (paragraph 25-3.2.5 of this Regulation) shall be considered satisfactory from the point of view of the fire-resistance test if the burn rate does not exceed 90 mm/min.

25-3.23.9.2 Rigid plastic panes (paragraph 25-3.2.6.1 of this Regulation), flexible plastic panes (paragraph 25-3.2.6.2. of this Regulation) and rigid plastic multiple glazed units (paragraph 25-3.2.8 of this Regulation)shall be considered satisfactory from the point of view of the fire resistance test if the burn rate does not exceed 110 mm/min.



In relation to the 'R' point,

test area shall be determined from the V points (see Fig 4), bounded by the intersection of the following four planes:

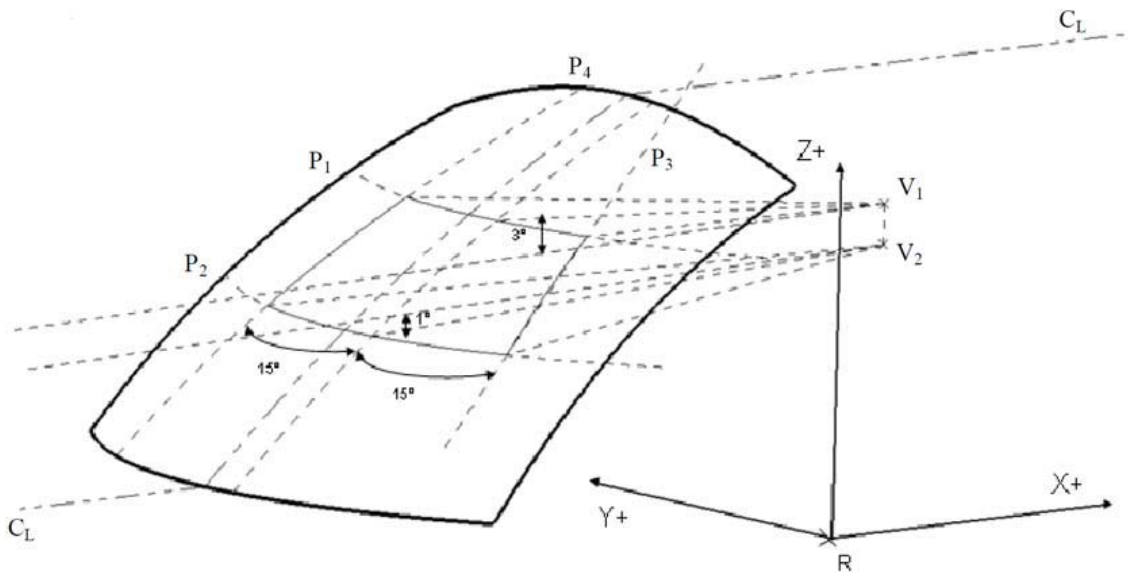
Plane 1: a plane inclined upwards from the X axis at 3 degrees, passing through V1, and parallel to the Y axis.

Plane 2: a plane inclined downwards from the X axis at 1 degrees, passing through V2, and parallel to the Y axis.

Plane 3: a vertical plane passing through V1 and V2 and inclined at 13 degrees to the left of the X axis.

Plane 4: a vertical plane passing through V1 and V2 and inclined at 20 degrees to the right of the X axis.

Fig 1. Test area A of windscreen



C_L: trace of the longitudinal median plane of the vehicle

Plane 1: a plane inclined upwards from the X axis at 3 degrees, passing through V1, and parallel to the Y axis.

Plane 2: a plane inclined downwards from the X axis at 1 degrees, passing through V2, and parallel to the Y axis.

Plane 3: a vertical plane passing through V1 and V2 and inclined at 15 degrees to the left of the X axis.

Plane 4: a vertical plane passing through V1 and V2 and inclined at 15 degrees to the right of the X axis.

Fig 1-1. Test area A (example of Central Driving Position)

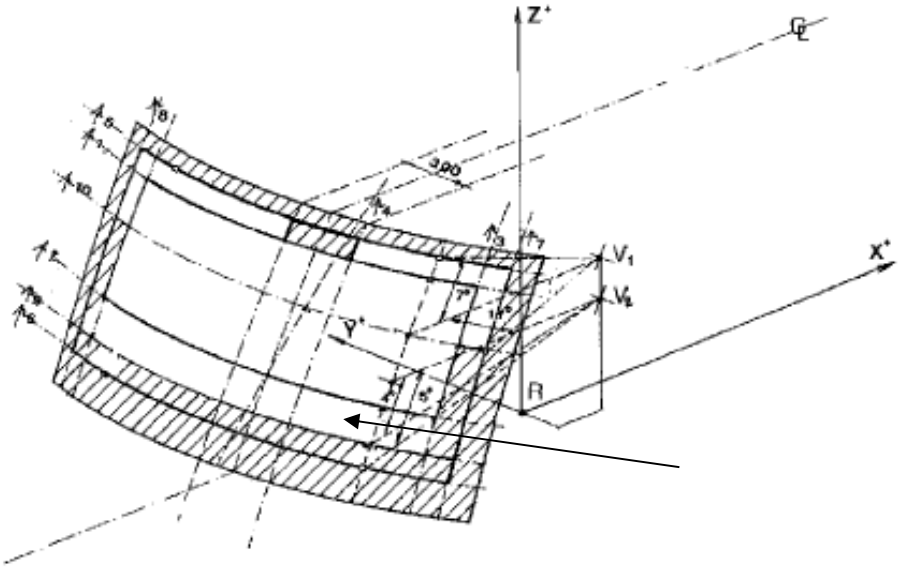


Fig 2. Test area B of windscreen (example 1)

Test Area B

In relation to the 'R' point,

test area shall be determined from the V points, bounded by the intersection of the following four planes:

Plane 5: a plane inclined upwards from the X axis at 7 degrees, passing through V1, and parallel to the Y axis.

Plane 6: a plane inclined downwards from the X axis at 5 degrees, passing through V2, and parallel to the Y axis.

Plane 7: a vertical plane passing through V1 and V2 and inclined at 17 degrees to the left of the X axis.

Plane 8: a plane symmetrical with respect to plane 7 in relation to the longitudinal median plane of the vehicle.

The reduced test plane B :

It ‘s the test area B with the exclusion of the following areas:

1. The test area A extended to the median plane of the vehicle, and in the corresponding part of the windscreen symmetrical to it about the longitudinal medium plane of the vehicle.

2. At the discretion of the vehicle manufacturer, one of the two following paragraphs may apply:

   (1) any opaque obscuration bounded downwards by plane 1 and laterally by plane 4 and its symmetrical in relation to the longitudinal median plane of the vehicle (plane 4');

   (2) any opaque obscuration bounded downwards by plane 1 provided it is inscribed in an area 300 mm wide centred on the longitudinal median plane of the vehicle and provided the opaque obscuration below the plane 5 trace is inscribed in an area limited laterally by the traces of planes passing by the limits of a 150 mm wide segment and parallel respectively to the traces of planes 4 and 4'

3. Any opaque obscuration bounded by the intersection of the outer surface of the windscreen:

   (1) with a plane inclined downwards from the X axis at 4 degrees, passing through V2, and parallel to the Y axis (plane 9);

   (2) with plane 6.

   (3) with planes 7 and 8 or the edge of the outer surface of the windscreen if the intersection of plane 6 with plane 7 (plane 6 with plane 8) doesn't cross the outer surface of the windscreen.

4. Any opaque obscuration bounded by the intersection of the outer surface of the windscreen:

   (1) with a horizontal plane passing through V1 (plane 10);

   (2) with plane 3;

   (3) with plane 7 or the edge of the outer surface of the windscreen if the intersection of plane 6 with plane 7 (plane 6 with plane 8) doesn't cross the outer surface of the windscreen;

   (4) with plane 9.

5. An area within 25 mm from the edge of the outer surface of the windscreen or from any opaque obscuration. This area shall

not impinge on the area in item 1. (i.e. the extended test area A).

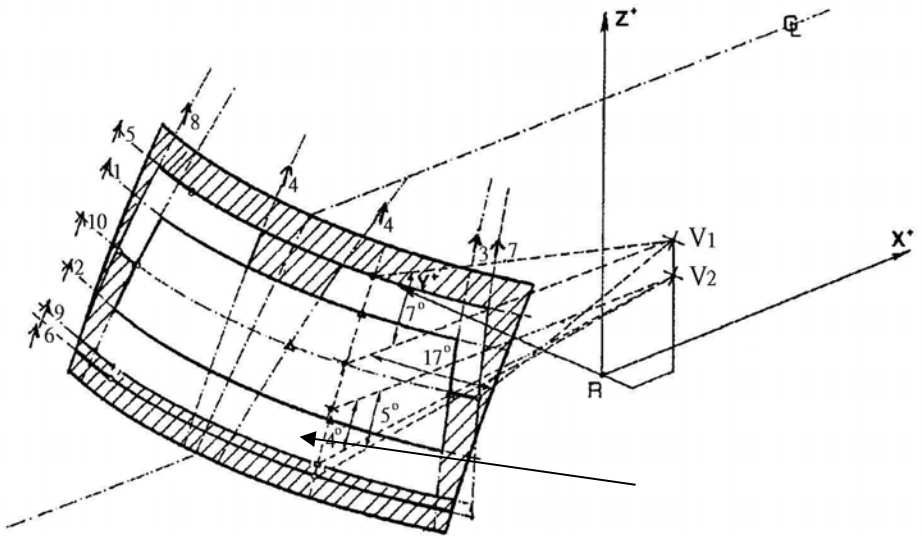
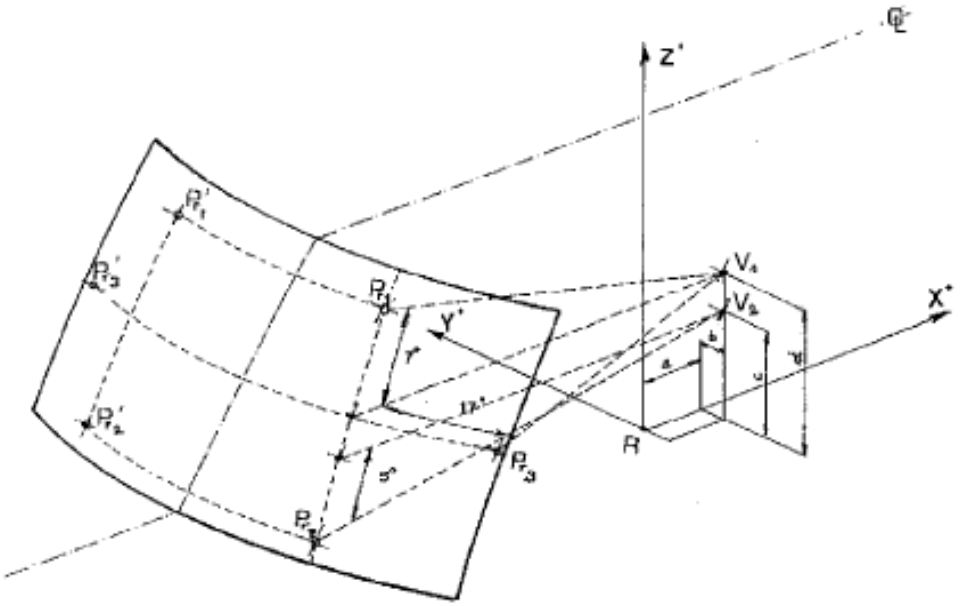


Fig 3. Test area B of windscreen (example 2)



1. Following gives the basic co-ordinates a, b, c and d for a design seat-back angle of 25 degrees:

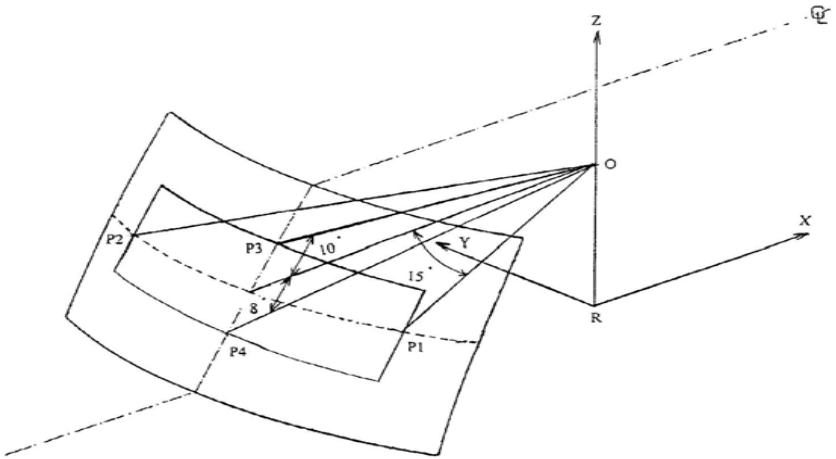
   V-point a: V1 = 68mm, V2= 68mm.

   V-point b: V1= -5mm, V2= -5mm.

   V-point c (d): V1 =665mm, V2=589mm.

2. Table 1 shows the further corrections to be made to the X and Z co-ordinates of each 'V' point when the design seat-back angle is not 25 degrees.

Fig 4. Determination of V points



Note:

1. Zone I is the windscreen zone determined by the intersection of the windscreen with the four planes defined below:

   P_1: a vertical plane passing through O and forming an angle of 15 degrees to the left of the median longitudinal plane of the vehicle;

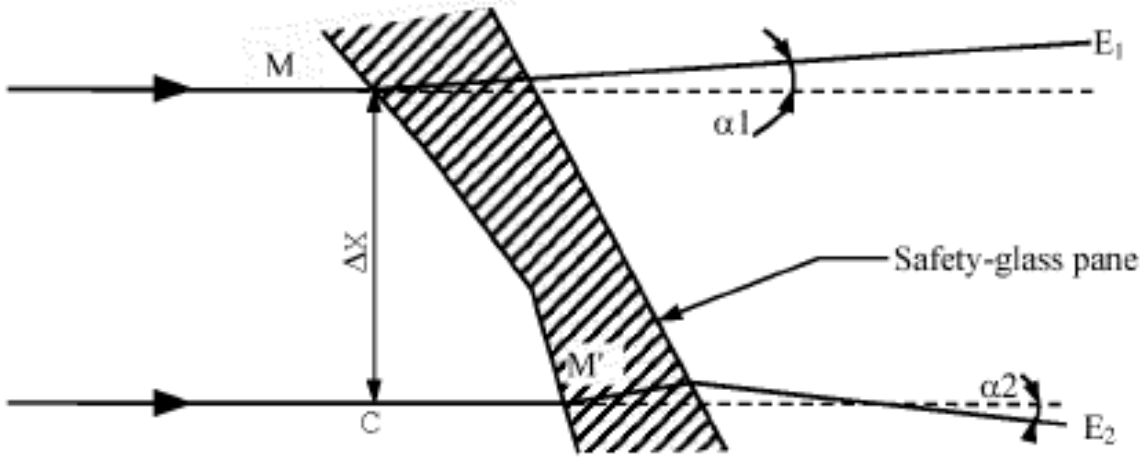
   P_2: a vertical plane symmetrical to P1 about the median longitudinal plane of the vehicle. If this is not possible (in the absence of a symmetrical median longitudinal plane, for instance) P2 shall be the plane symmetrical to P1 about the longitudinal plane of the vehicle passing through point O.

   P_3: a plane passing through the straight line OQ and forming an angle of 10 degrees above the horizontal plane;

   P_4: a plane passing through the straight line OQ and forming an angle of 8 degrees below the horizontal plane.

2. The “eye-point” O which is the point located 625 mm above the point R of the driver's seat in the vertical plane parallel to the longitudinal median plane of the vehicle for which the windscreen is intended, passing through the axis of the steering wheel.
3. The straight line OQ which is the horizontal straight line passing through the eye point O and perpendicular to the median longitudinal plane of the vehicle.

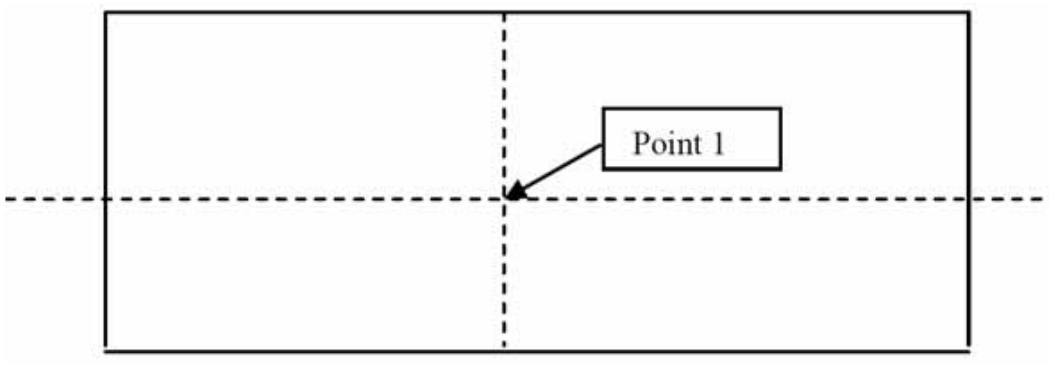
Fig 5. Test area I



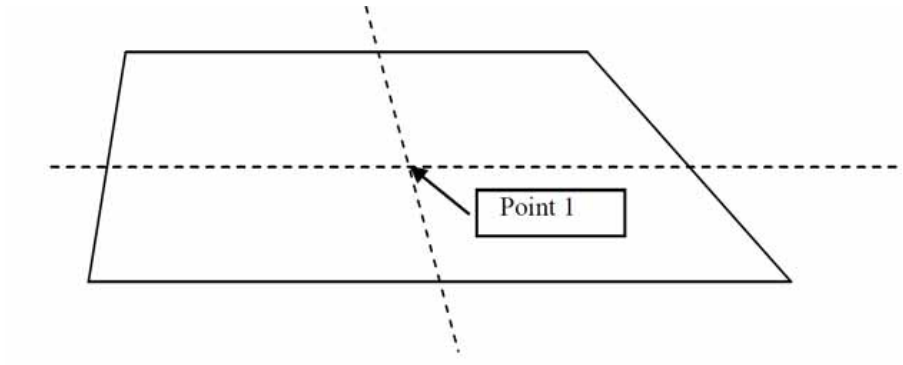
Note: $\Delta\alpha = \alpha_1 - \alpha_2$ is the optical distortion in the direction M-M´.

Δx = MC is the distance between two straight lines parallel to the direction of vision and passing through the points M and M´.

Fig 6. Diagrammatic representation of optical distortion



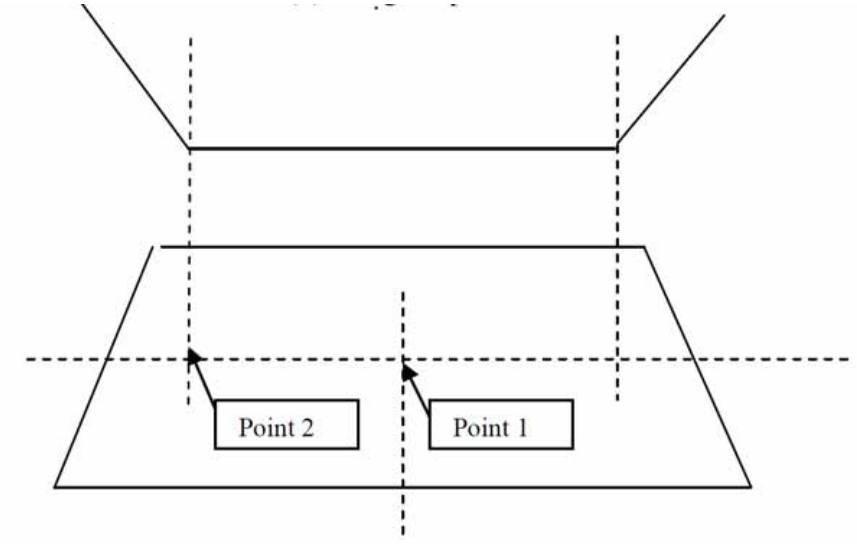
(a) flat glass pan



(b) flat glass pan

Point 1: In the geometric centre of the glass.

Fig 7. Prescribed points of impact for uniformly toughened flat glass panes



Point 1: In the geometric centre of the glass.

Point 2: For curved glass panes having a minimum radius of curvature "r" of less than 200 mm. The point shall be selected on the largest median in that part of the pane where the radius of curvature is smallest.

Fig 7-1. Prescribed points of impact for uniformly toughened curved glass panes

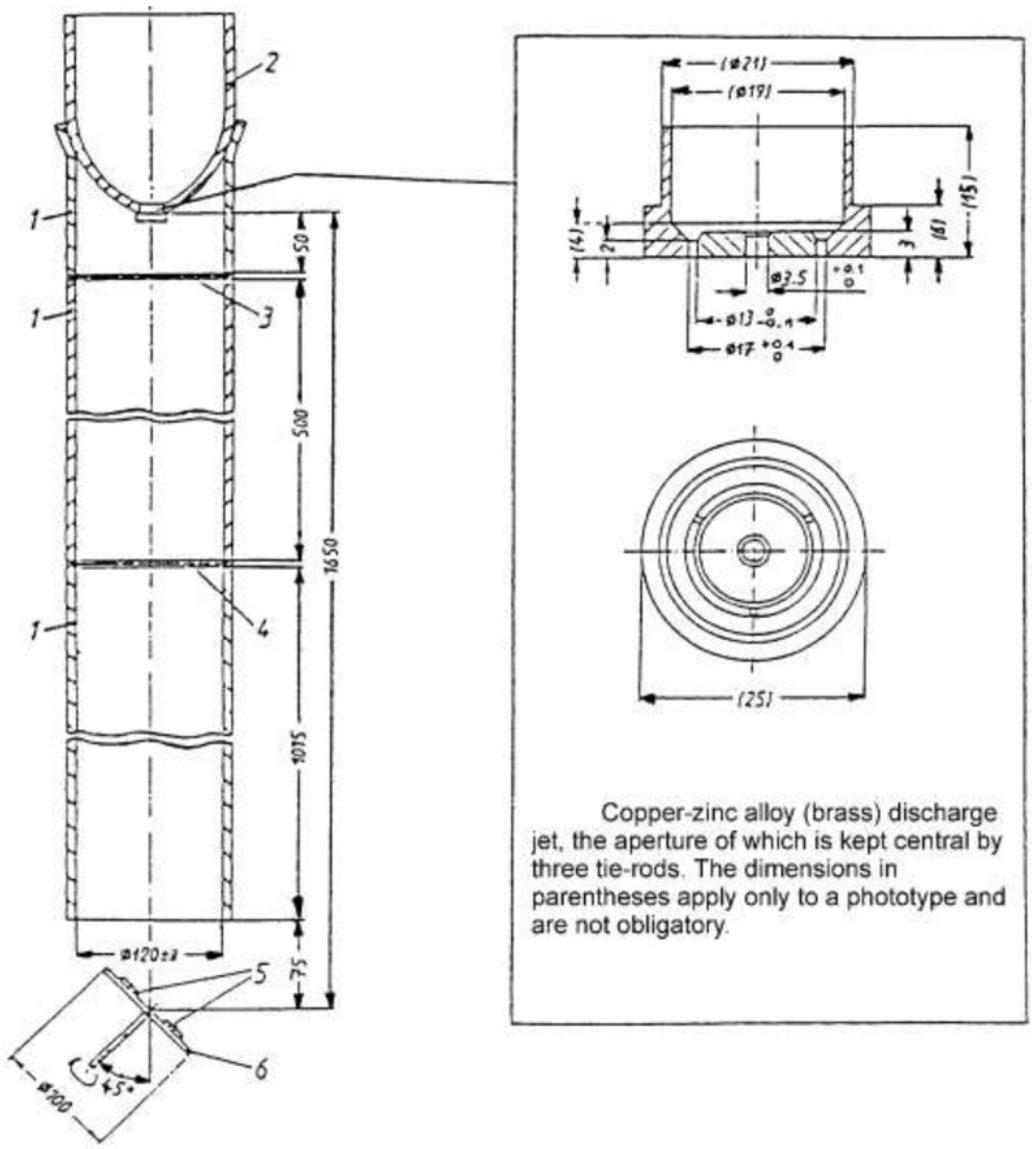


Figure 8: Sand drop equipment

Key

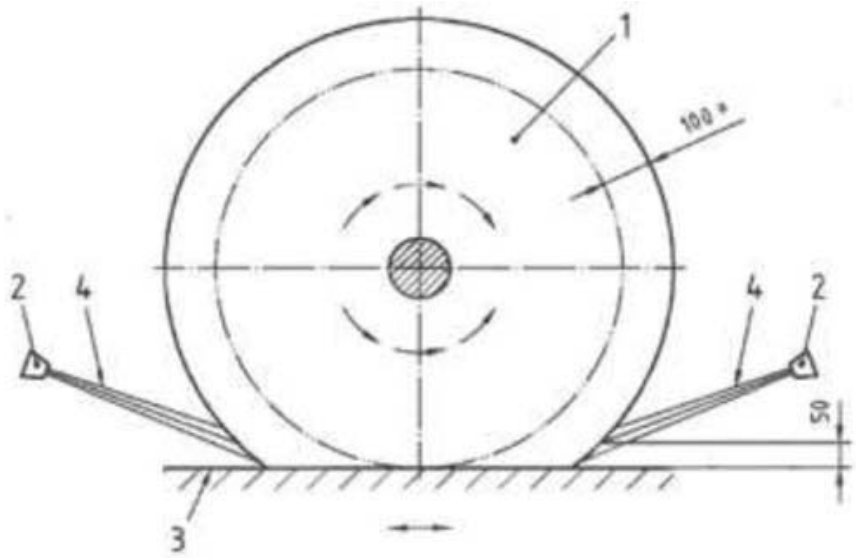
1 Brush

2 Spray nozzle

3 Test panel holder

4 Spray jet (horizontal middle of the jet strikes brush 50 mm above table directly in the brush)

a Penetration depth



Dimensions in mm

Figure 9: Movement pattern of washing brush and nozzle

Key:

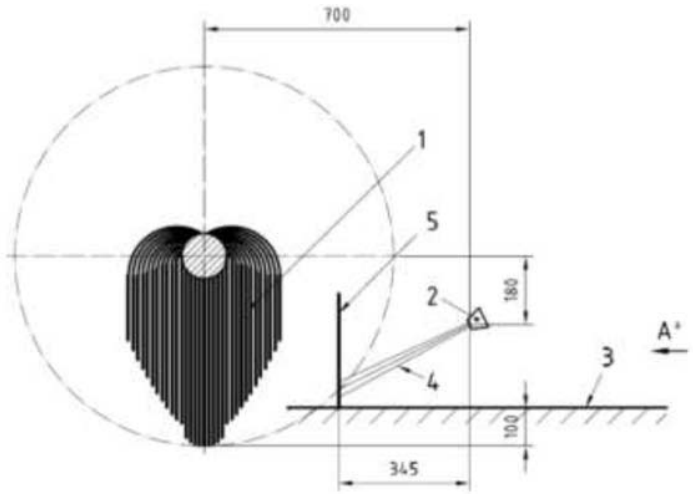
1 Brush

2 Spray nozzle

3 Test panel holder

4 Spray jet

5 Sheet of cardboard



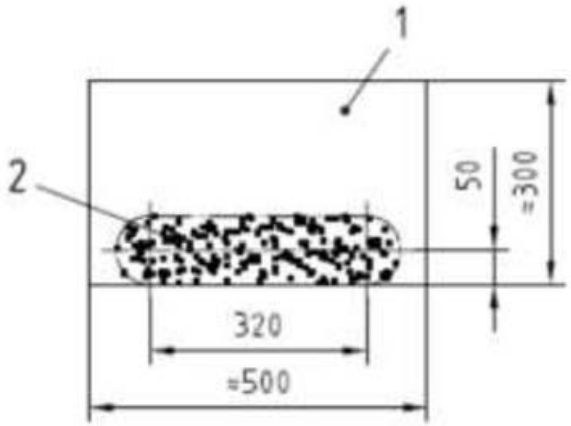
Dimensions in mm

Figure 10: Calibration arrangement

Key:

1 Sheet of cardboard

2 Spray pattern



Dimensions in mm

Furthermore perform a trial run without a test panel, carrying out 10 washing operations
(10 double passes), to distribute the suspension evenly in the apparatus.
Determine the initial haze of the sample as in paragraph 25-3.10.2 of this Regulation.

Figure 11: View A of spray pattern

Key:

1 Test panel holder movement

2 Supporting plate 150 mm x 300 mm

3 Available positions for the samples (50 mm x 100 mm) within the test area

4 Example for positioning the three different sample types in the test area

5 No sample in this area (at least 50 mm at the start and finish of the test panel holder and at least 30 mm edgewise to the direction of travel of the test panel holder)

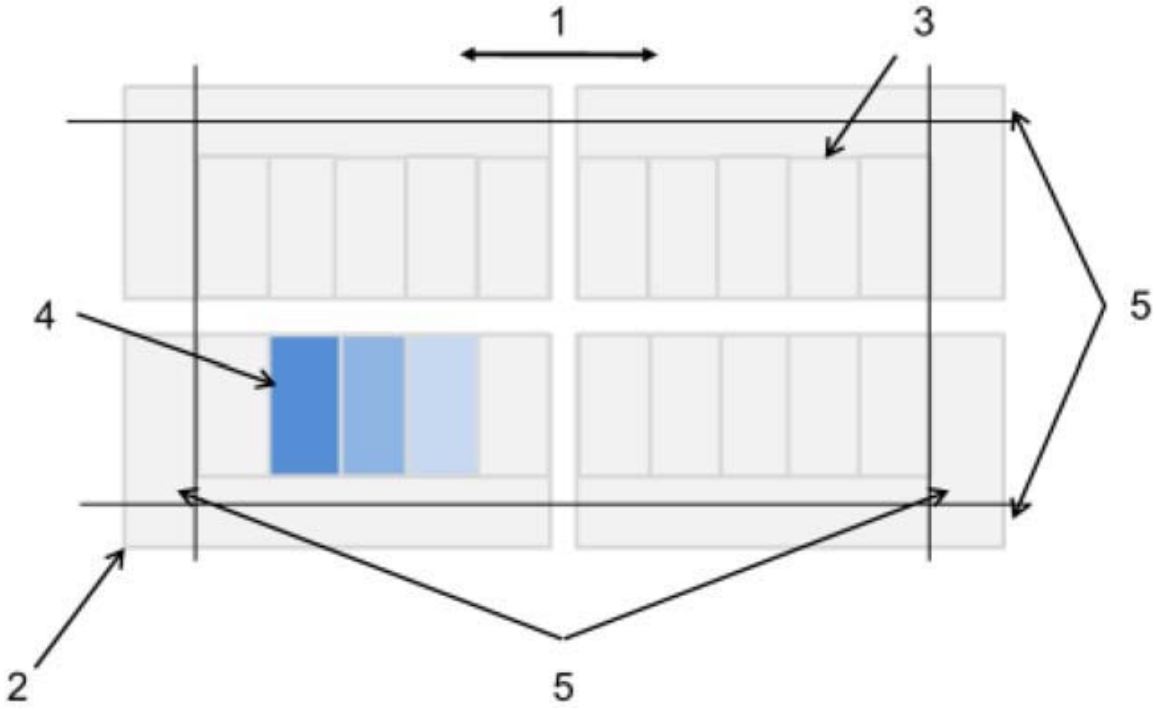


Figure 12: Description of sample positioning on the test panel holder

Key

1 Wiper carriage assembly moving back and forth

2 Self-supporting arm

3 Wiper blade holder

4 Wiper blade

5 Sample box working as test sample holder and as container for the aqueous suspension

6 Test sample

7 Spacer plaque (with a soft masking film on the surface to avoid scratching the sample placed on top of it)
to adjust height of the sample to the level of the bottom surface of the sample box

8 Adhesive tape to fix sample and to seal the gap between sample and its box

9 Aqueous suspension filled into the box

10 Adhesive tape to fix the sample box onto the stainless steel tray

11 Stainless steel tray

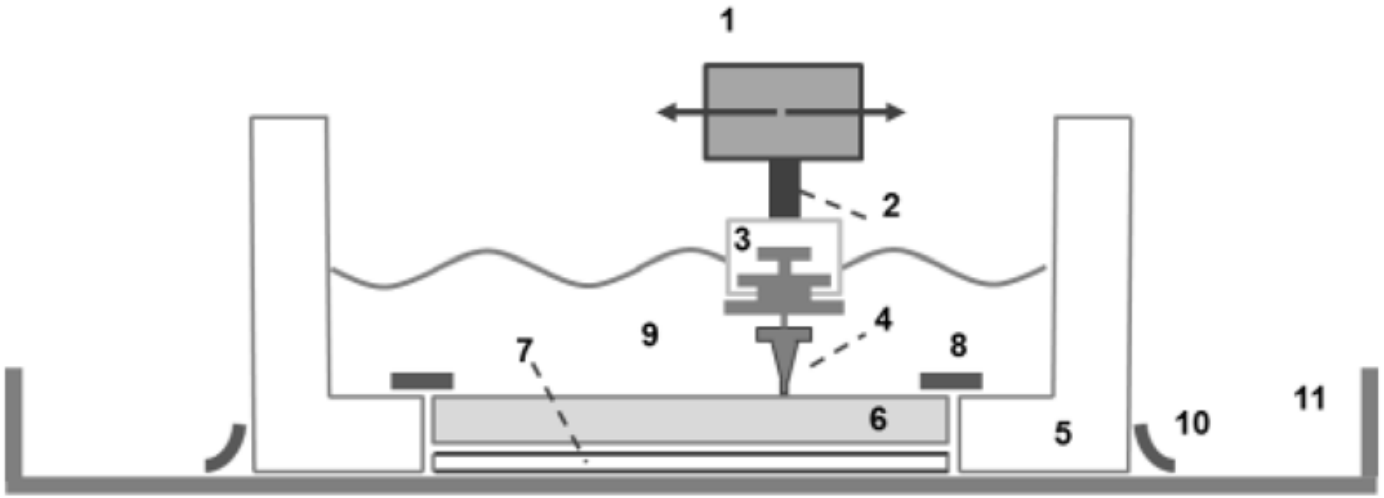


Figure 13: Cross-section view of the apparatus

Key

1 Wiper carriage assembly moving back and forth

5 Sample box working as test sample holder and as container for the aqueous suspension

6 Test sample

8 Adhesive tape to fix sample and to seal the gap between sample and its box

9 Aqueous suspension filled into the box

10 Adhesive tape5 to fix the sample box onto the stainless steel tray

11 Stainless steel tray

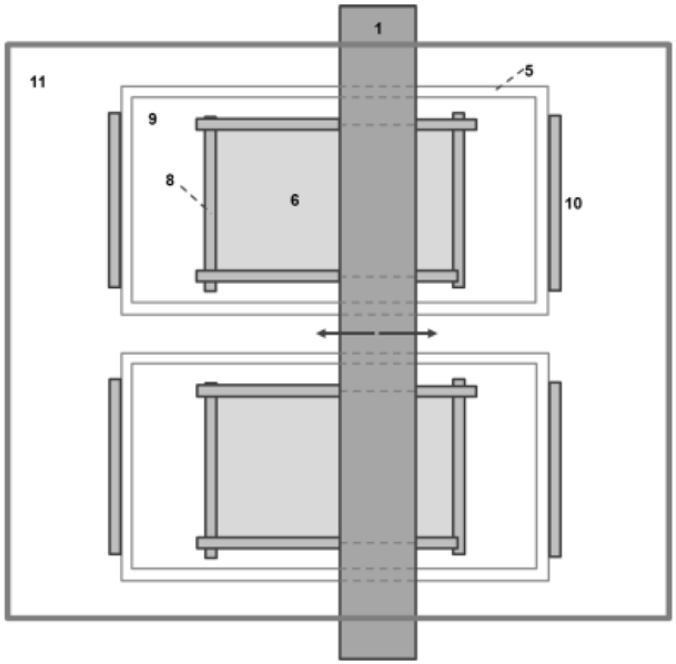


Figure 14: Bird's-eye view of the apparatus

Key

1 Wiper blade lip (5 mm long)

2 Wiper blade hinge (0.5 mm width)

3 Wiper blade heel (5 mm long and used to fix the wiper blade to the wiper blade holder)

4 Total length of the wiper blade 11 mm

5 Total width of the wiper blade 9 mm

6 Groove used to fix the wiper blade to the wiper blade holder (parts below the arrow are outside the wiper blade holder and parts above are within the guide rail of the wiper blade holder)

7 Wiper blade extremity (0.6 mm width)

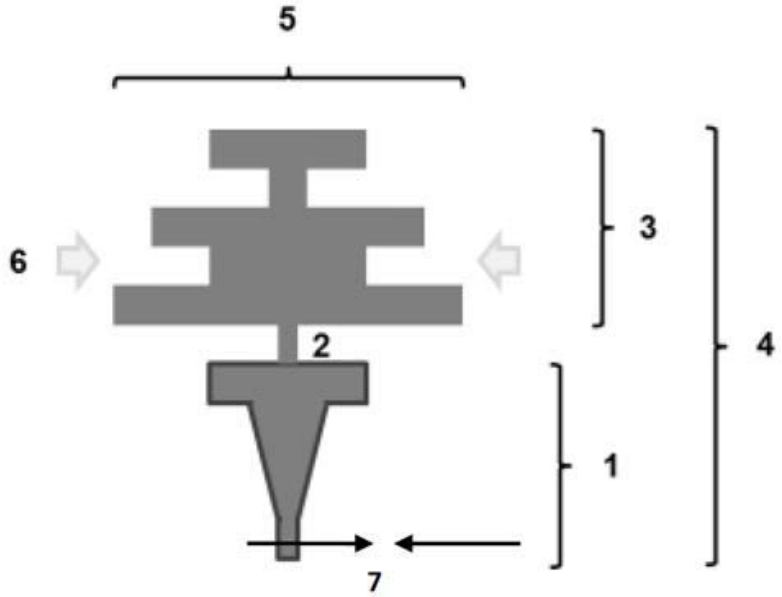


Figure 15: Cross profile of the chloroprene type rubber blade

Key

1 Wiper carriage assembly moving back and forth

2 Self-supporting arm

3 Wiper blade holder

4 Wiper blade

11 Stainless steel tray

Pre-check

A Align base plate with spirit level

B Align wiper carriage assembly with spirit level

C Check that the bearings of the self-supporting arms have all the same distance

D Control visually that the wiper blade touches the base plate uniformly

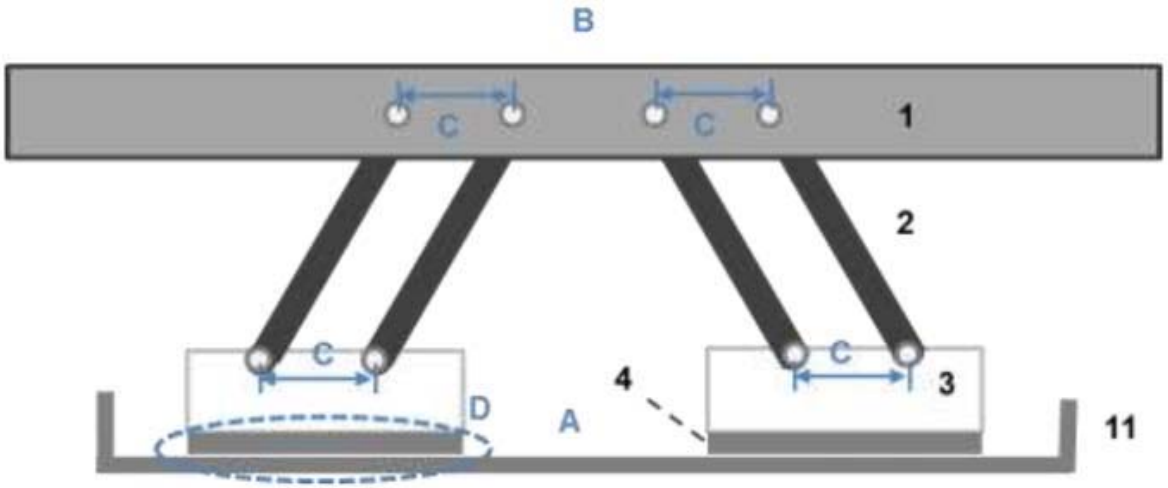


Figure 16: Equipment pre-check

Key

A Align base plate with spirit level

B Align wiper carriage assembly with spirit level

C Check that the bearings of the self-supporting arms have all the same distance

D Control visually that the wiper blade touches the base plate uniformly

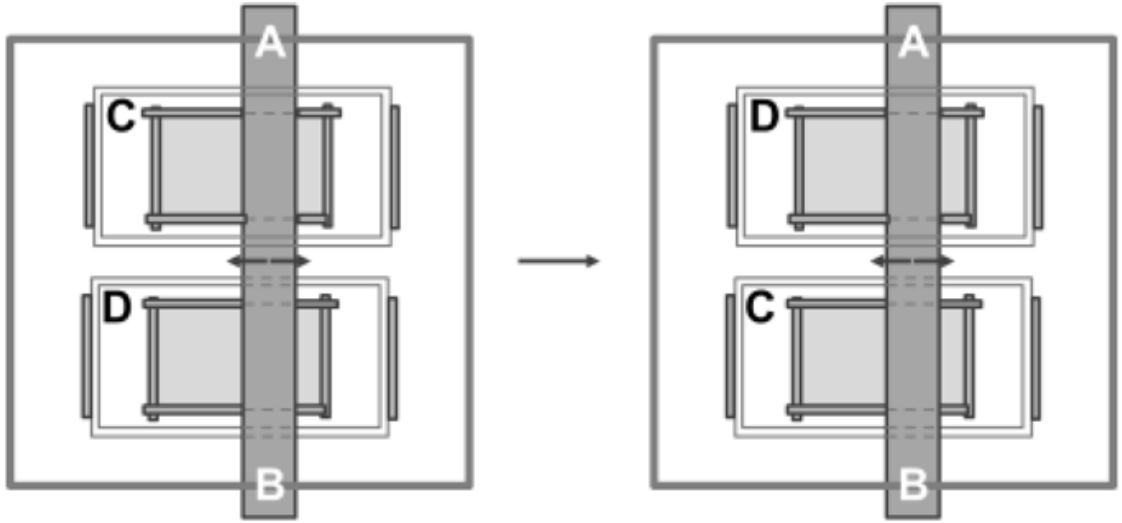


Figure 17: Rearrangement of the sample boxes

Key

1 Sample (150 mm x 100 mm)

2 Wiping area on the sample (130 mm x 80 mm)

3 Measurement area on the sample (75 mm x 60 mm)

4 Locations of the 9 reading areas of the haze measurement (including coordinates of the centre of the area)

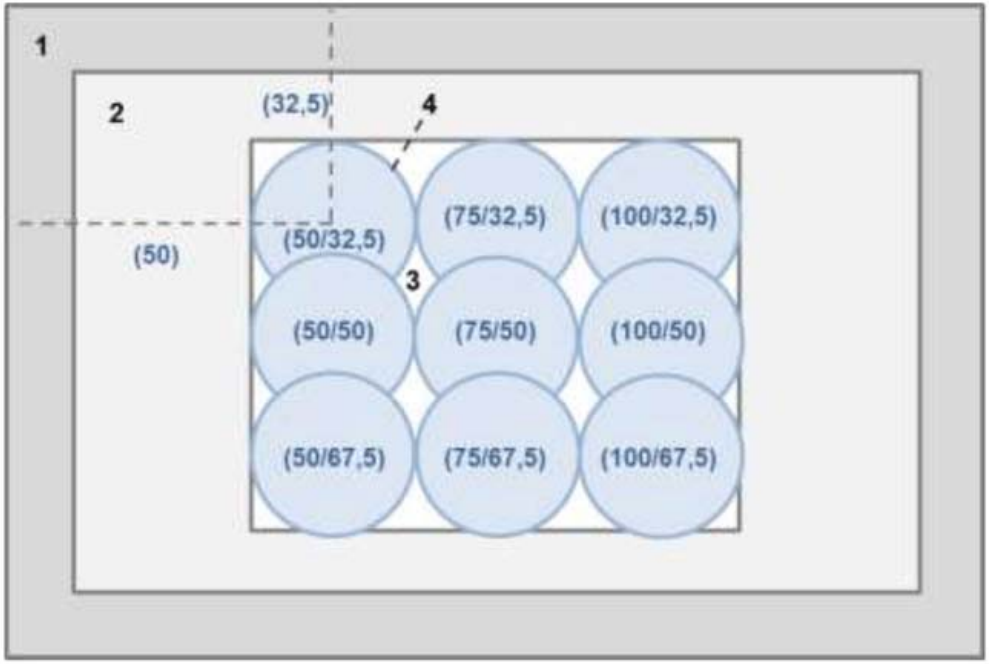


Figure 18: Measurement points across the sample

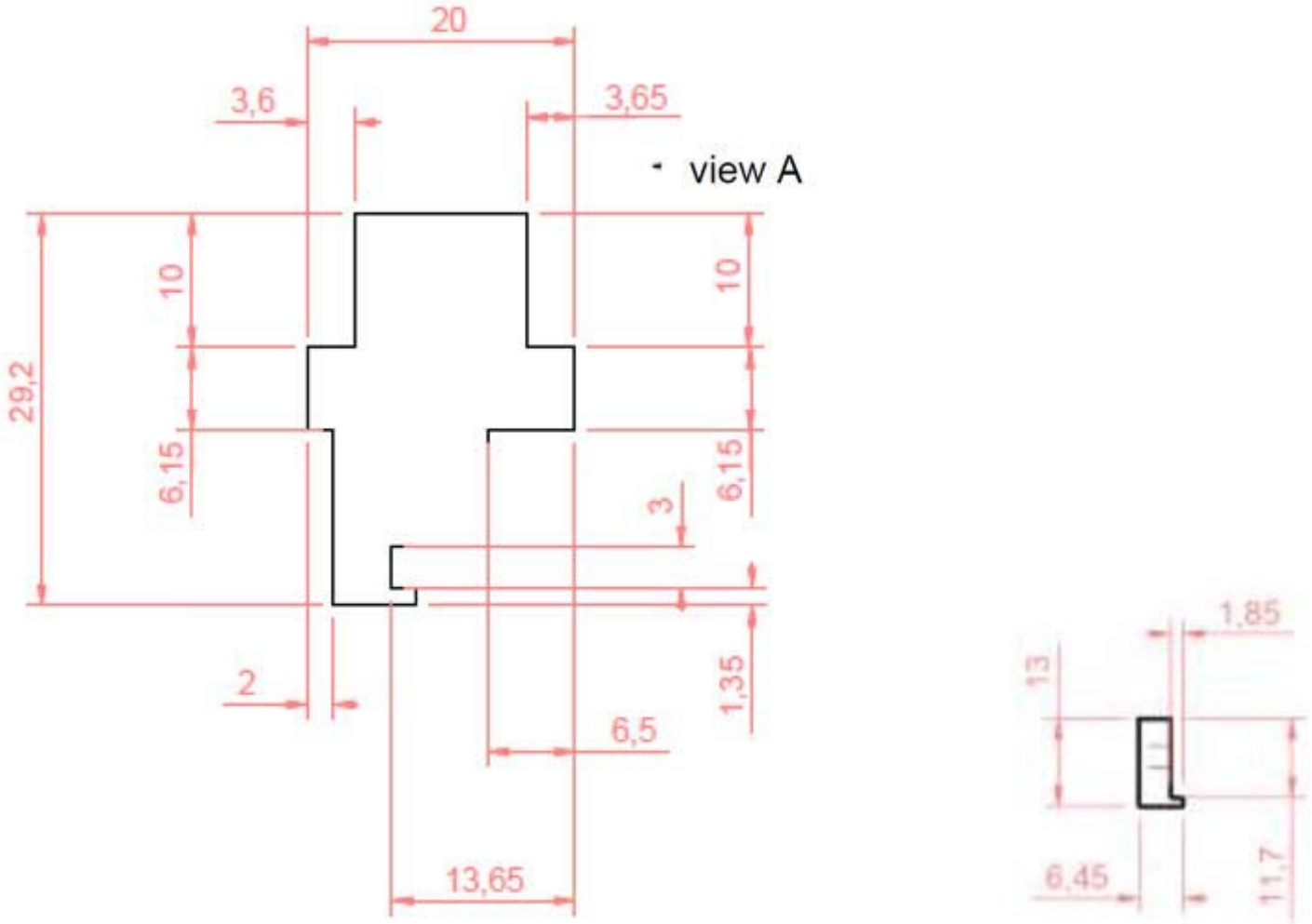


Figure 19: Cross-cut view of the wiper blade holder with the support plate (left side) and the clamping plate (right side)

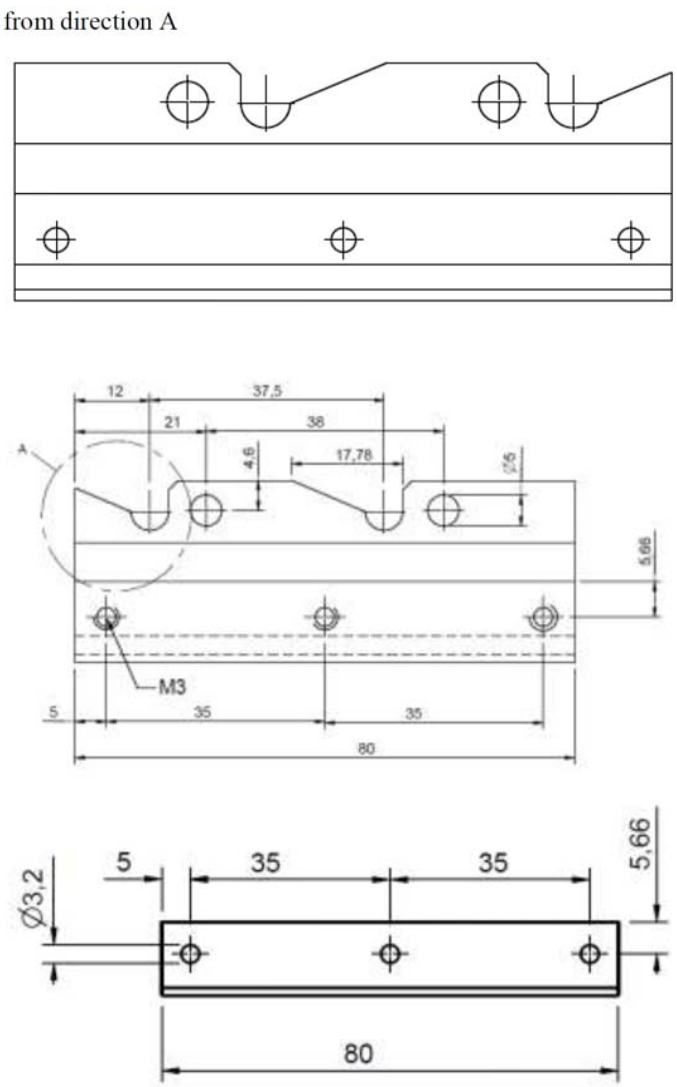
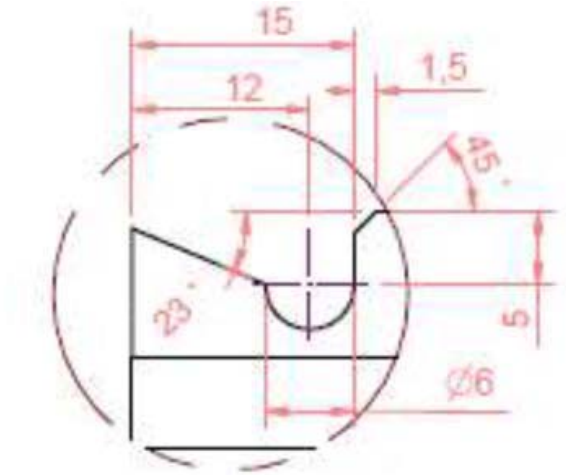


Figure 20: Side view of the support plate (left side) and the clamping plate (right side)



area A

Figure 21: Details regarding the area A in figure 2

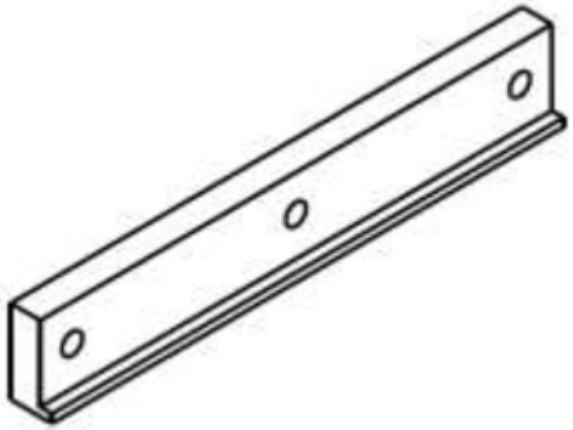


Figure 22: 3-D view of the wiper blade holder (after inserting the wiper blade into the support plate, the clamping plate is attached and fixed using three screws)

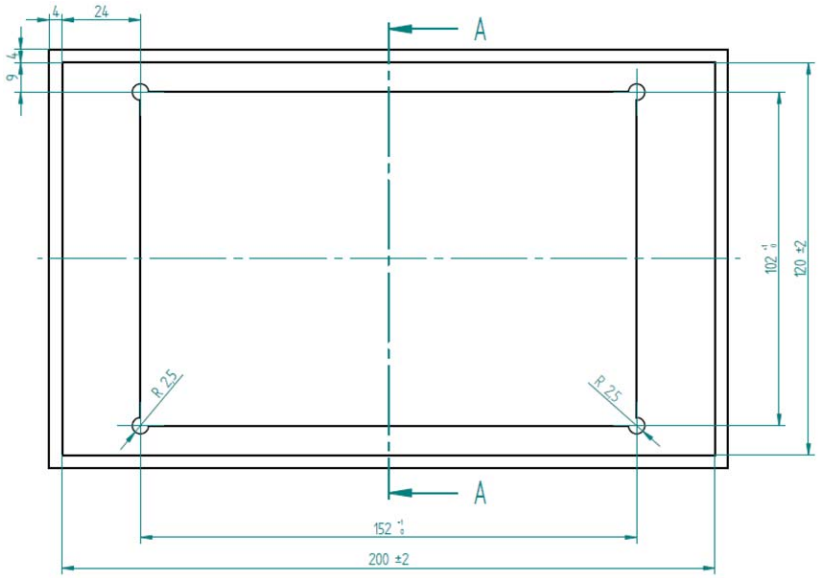


Figure 23: Bird's-eye view of the box (dimensions are in mm)

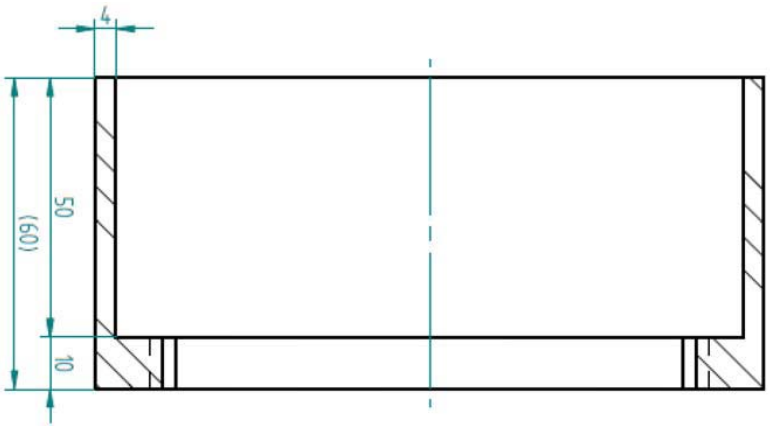


Figure 24: Cross cut view at A

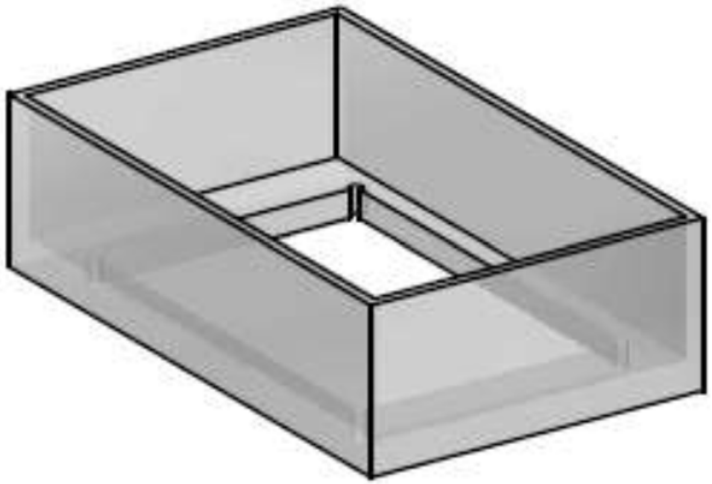


Figure 25: 3-D view of the box

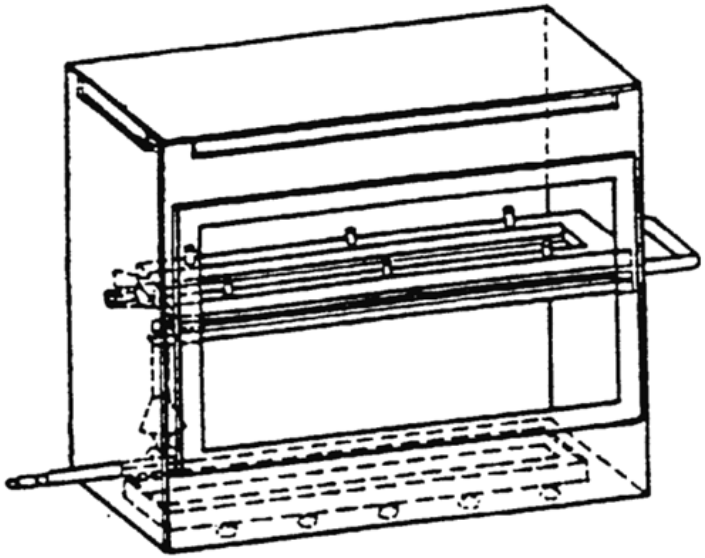


Figure 26: Example of combustion chamber with sample holder and drip pan

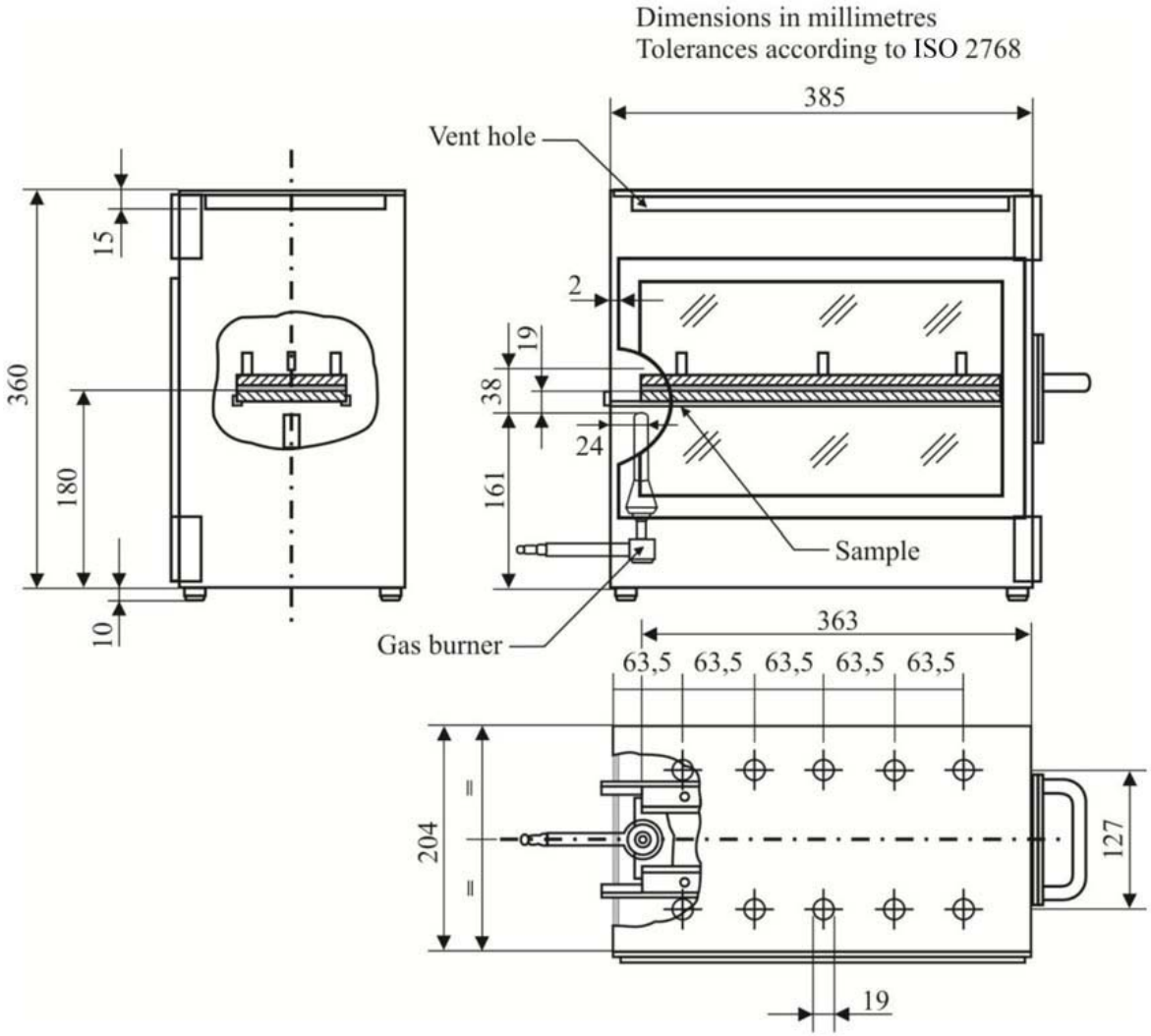


Figure 27: Example of combustion chamber

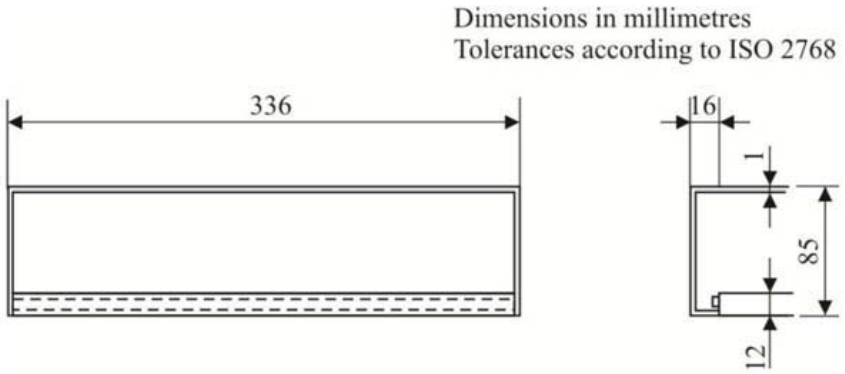


Figure 28: Typical drip pan

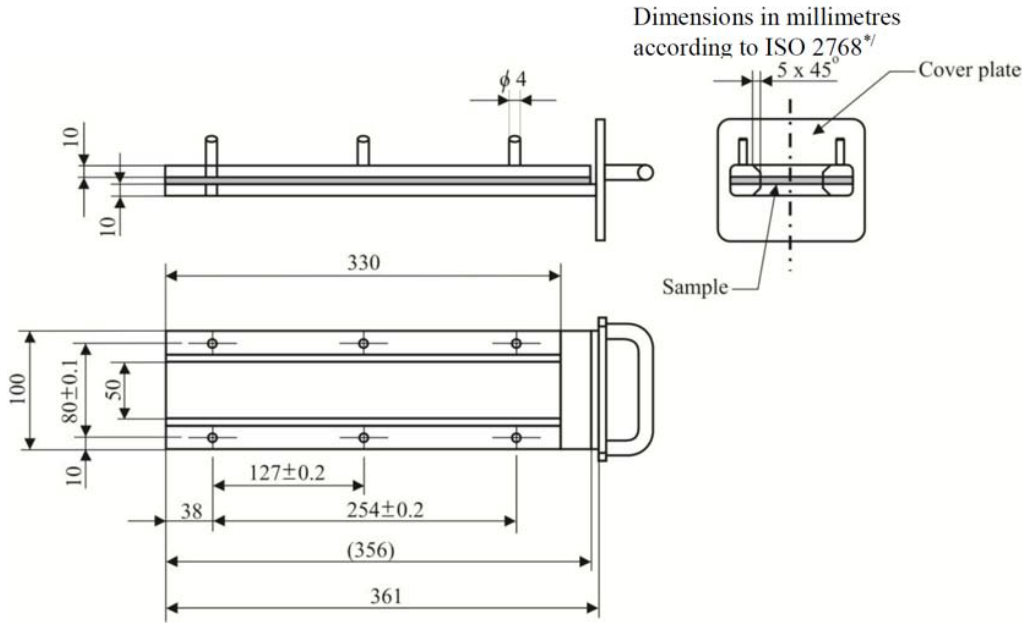


Figure 29: Example of sample holder

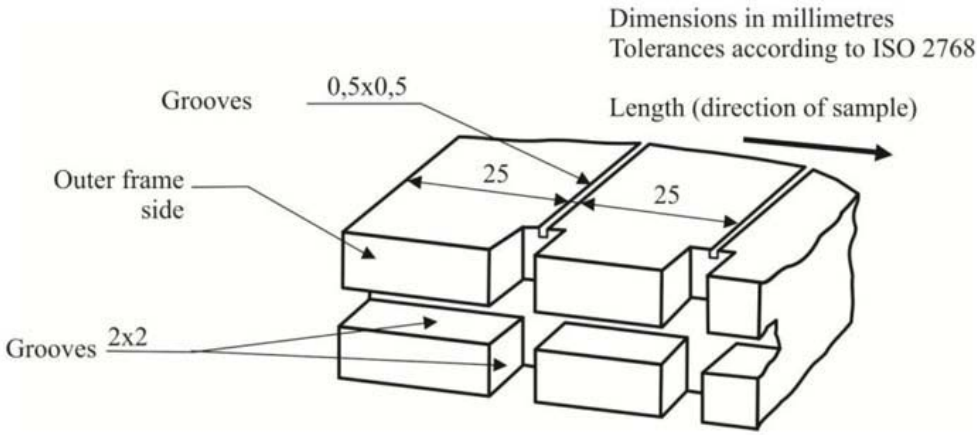


Figure 30: Example of section of lower U-frame design for wire support facility

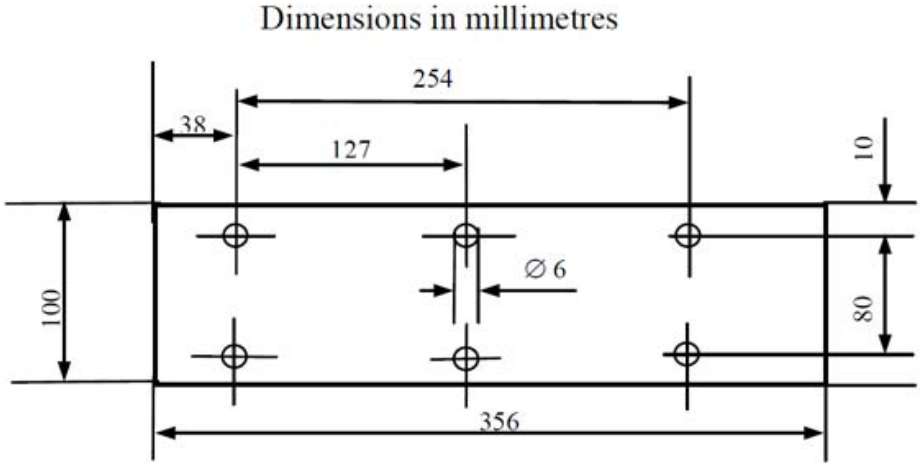


Figure 31: Sample

Table 1. Correction for design seat-back angles other than 25 degrees

Seatback angle(in degrees)	Horizontal coordinates X	Vertical coordinates Z	Seatback angle(°)	Horizontal coordinates X	Vertical coordinates Z
5	-186 mm	28 mm	23	- 17mm	5 mm
6	-176 mm	27 mm	24	- 9 mm	2 mm
7	-167 mm	27 mm	25	0 mm	0 mm
8	-157 mm	26 mm	26	9 mm	- 3 mm
9	-147 mm	26 mm	27	17 mm	- 5 mm
10	-137 mm	25 mm	28	26 mm	- 8 mm
11	-128 mm	24 mm	29	34 mm	-11 mm
12	-118 mm	23 mm	30	43 mm	-14 mm
13	-109 mm	22 mm	31	51 mm	-17 mm
14	- 99 mm	21 mm	32	59 mm	-21 mm
15	- 90 mm	20 mm	33	67 mm	-24 mm
16	- 81 mm	18 mm	34	76 mm	-28 mm
17	- 71 mm	17 mm	35	84 mm	-31 mm
18	- 62 mm	15 mm	36	92 mm	-35 mm
19	- 53 mm	13 mm	37	100 mm	-39 mm
20	- 44 mm	11 mm	38	107 mm	-43 mm
21	- 35 mm	9 mm	39	115 mm	-47 mm
22	- 26 mm	7 mm	40	123 mm	-52 mm

Table 2. Principal characteristic parameter

Tests \ Scope	Windscreen				Glass panes other than windscreens							
	Laminated-glass windscreens (L)	Rigid plastic windscreens	Laminated rigid plastic windscreens	Glass-plastics windscreens	Toughened-glass (T)	Laminated-glass panes (L)	Rigid plastic panes	Rigid plastic multiple glazed units	Flexible plastic panes	Laminated rigid plastic panes	Safety glazing faced with plastics material (on the inside)	Glass-plastics panes
Trade names or marks	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎	Corresponding to the toughened-glass or laminated-glass panes requirements	◎
Chemical designation of the material	---	◎	◎	---	---	---	◎	◎	◎	◎		---
The classification of the material by the applicant	---	◎	◎	---	---	---	◎	◎	◎	◎		---
Process of manufacture	---	◎	◎	---	---	---	◎	◎	◎	◎		---
Shape and dimensions	◎	◎	◎	◎	---	---	◎	---	◎	◎		---
Colouring of the plastic product	---	◎	◎	---	---	---	◎	---	◎	◎		---
Nature and type of surface coating	---	◎	◎	---	---	---	◎	◎	◎	◎		---
The nominal thickness of the glass layers or interlayer or interlayers,	◎	◎	◎	◎	◎	◎	◎	◎	◎	◎		---
The nature and type of the interlayer or interlayers,	---	---	◎	---	---	◎	---	◎	---	◎		---
The number of layers of glass	◎	---	---	---	---	---	---	---	---	---		---

The official directions are written in Chinese, this English edition is for your reference only.

The number of plastics layers	---	---	---	◎	---	---	---	---	---	---		---
The nature and type of the layer(s) of plastics acting as interlayer(s) (e.g. PVB or other material) and of the plastics layer situated on the inner face,	---	---	---	◎	---	---	---	---	---	---		◎
Any special treatment which one of the layers of plastic may have undergone.	---	---	◎	---	---	---	---	---	---	◎		---
Any special treatment the glazing may have undergone.	---	---	---	◎	---	◎	---	---	---	---		◎
The nature of the toughening process (thermal or chemical)	---	---	---	---	◎	---	---	---	---	---		---
The shape category	---	---	---	---	◎	---	---	---	---	---		---

Table 3. Secondary characteristic parameter

Tests \ Scope	Windscreen				Glass panes other than windscreens							
	Laminated-glass windscreens (L)	Rigid plastic windscreens	Laminated rigid plastic windscreens	Glass-plastics windscreens	Toughened-glass (T)	Laminated-glass panes (L)	Rigid plastic panes	Rigid plastic multiple glazed units	Flexible plastic panes	Laminated rigid plastic panes	Safety glazing faced with plastics material (on the inside)	Glass-plastics panes
The incorporation or otherwise of	◎	◎	◎	◎	◎	◎	◎	---	---	◎	Correspondin	◎

conductors.											g to the toughened-glass or laminated-glass panes requirements	
The incorporation or otherwise of opaque obscuration.	◎	◎	◎	---	---	---	---	---	---	---		---
The colouring (total or partial) of the interlayer (colourless or tinted).	---	---	◎	---	---	◎	---	---	---	◎		---
The colouring (total or partial) of the interlayer or interlayers (colourless or tinted),	◎	---	---	◎	---	---	---	---	---	---		◎
The presence or absence of conductors or heating elements	◎	---	◎	◎	◎	◎	◎	---	---	◎		◎
The nature of the material (polished (plate) glass, float glass, sheet glass)	◎	---	---	◎	◎	◎	---	---	---	---		◎
The colouring of the glass (colourless or tinted),	◎	---	---	◎	◎	◎	---	---	---	---		---

Table 4. The term indices of difficulty of secondary characteristic parameter

Scope / Tests	With or without conductors	With or without opaque obscuration	Colouring of the interlayer	Colouring of the interlayer or of the plastics coating	With or without heating elements

Thickness test	---	---	---	---	---
Fragmentation test	---	---	---	---	---
227 g ball test	◎	◎	---	---	◎
2260 g ball test	---	---	---	---	---
Headform test	---	---	---	---	---
Test of resistance to abrasion	---	---	---	---	---
Test of resistance to high temperature	---	---	---	---	---
Resistance-to-radiation test	---	---	---	---	---
Resistance-to-humidity test	---	---	---	---	---
Light-transmission test	---	---	---	---	---
Optical-distortion test	---	---	---	---	---
Secondary-image-separation test	---	---	---	---	---
Test of flexible	---	---	---	---	---
Resistance to simulated weathering	---	---	---	---	---
Test of resistance to temperature changes	---	---	◎	◎	---
Burning behaviour (fire-resistance) test	---	---	---	---	---