

Unofficial Translation

In the event of any doubt or misunderstanding arising from this translation, the standard in Thai will be held to be authoritative.

**Thai Industrial Standard
For
Automobile Safety Glasses :
Zone Tempered Glass
TIS 198-2536(1993)**

1. Scope

- 1.1 This standard specifies grades, thickness and tolerances, material, requirements, mark and label, sampling and criteria for conformity and testing for automobile safety glasses: zone tempered glass.
- 1.2 This standard covers zone tempered safety glass which is transparent, both coloured and colourless, intended to be used for windscreen; it does not cover safety glass made for the purpose of bullet resistance.

2. Definitions

For the purpose of this standard the following definitions apply:

- 2.1 SAFETY GLASS: A glass which has been subjected to a specific treatment such that, if fractured, it is less likely to cause severe cuts or serious physical injuries.
- 2.2 AUTOMOTIVE SAFETY GLASSES: ZONE TEMPERED SAFETY GLASS hereinafter referred to as ZONE TEMPERED GLASS: A safety glass intended for automobile part made by subjecting to a conditioning process such that fragmentation of the glass comprises sufficient pieces of larger size than elsewhere to afford better vision through the zone in front of the driver than through the remainder of the glass which disintegrates into small pieces.
- 2.3 SCRATCH: Scar produced on the glass surface either during manufacturing or handling process of the product. The scar can be classified as heavy and light. A heavy scar can be easily felt but a light scar may not.
- 2.4 INCLUSION MATERIALS: Coloured bubbles, unmelted substances and devitrification contained in the glass.
- 2.5 PRIMARY VISION AREA: The part of the windscreen through which the principal field of view is obtained as in Figure 1.
- 2.6 SECONDARY IMAGE: A spurious image, usually seen at night when the object being viewed is very bright in relation to its surroundings, e.g. the headlight of an approaching vehicle is seen as a bright primary image with at least one less bright juxtaposed secondary image.

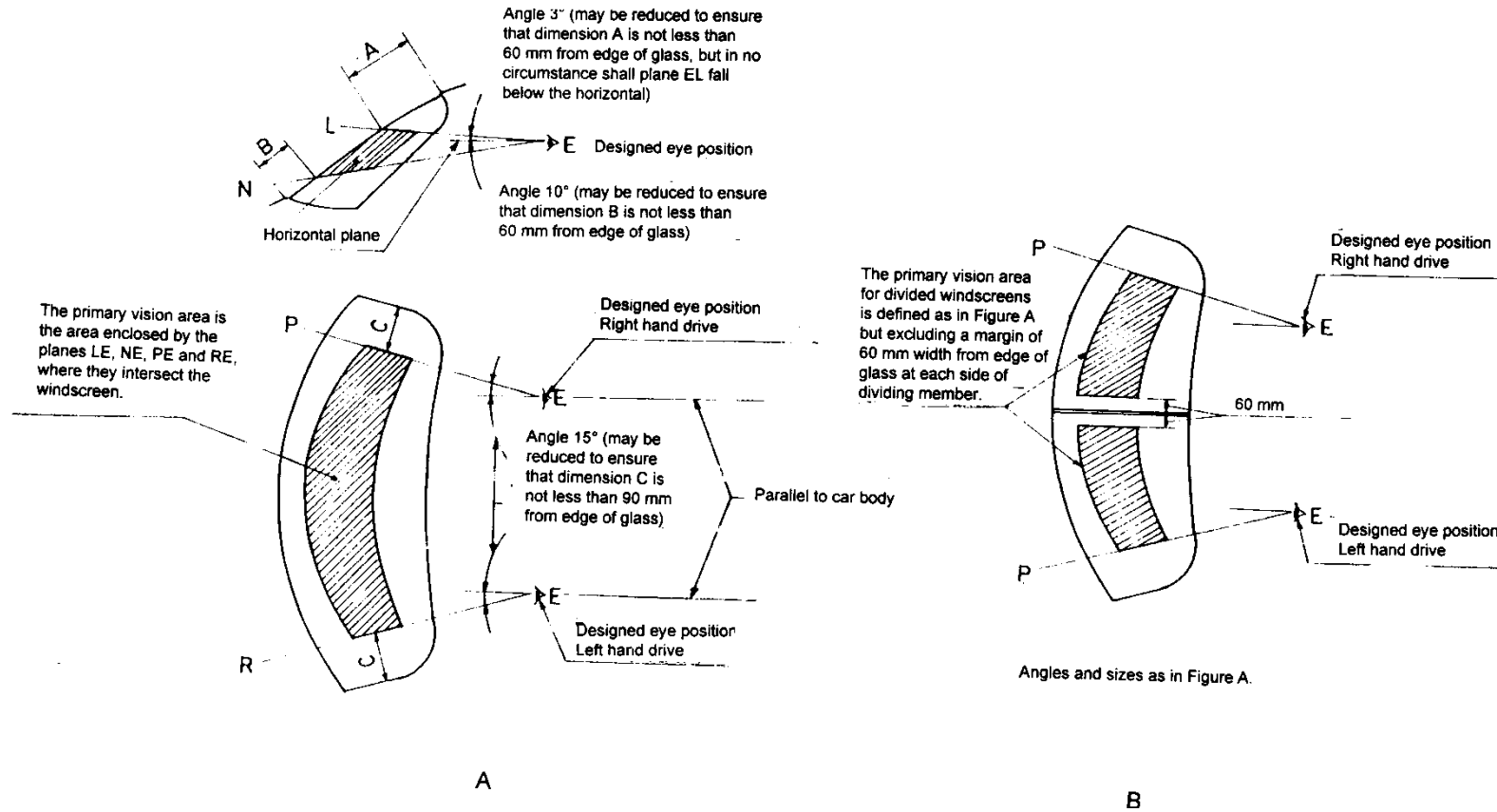


Figure 1 Primary vision area for optical tests on windscreen
(clause 2.5)

3. Thickness and tolerances

- 3.1 The thickness and tolerances of zone tempered safety glass shall conform to Table 1.

Test shall conform to TIS 195, "Test methods for automobile safety glasses".

Table 1
Thickness and tolerances
(clause 3.1)

Units in mm		
Nominal thickness	Thickness	Tolerance
5	5.0	± 0.3
6	6.0	

4. Material

- 4.1 It is recommended that zone tempered glass be made of float glass.

5. Requirements

- 5.1 Appearance
Appearance shall conform to Table 2.
Test shall be in accordance with TIS 195.
- 5.2 Visible light transmission
When tested as in TIS 195, the rate of visible light transmission shall not be less than 70%.
- 5.3 Secondary image separation
When tested as in TIS 195, the maximum secondary image separation shall not exceed 15 minutes of arc when viewed through the primary vision area.
- 5.4 Distortion of vision
When tested as in TIS 195, the angular deviation changes shall not exceed 15 minutes of arc when viewed through the primary vision area.
- 5.5 Colour identification
When tested as in TIS 195, the colour white, yellow, red, green, blue and amber on the colour board shall be identifiable.
- 5.6 Impact resistance - head form test
When tested as in TIS 195, the zone tempered glass shall be fractured.

Table 2
Appearance of zone tempered safety glass
(clause 5.1)

Defect	Limitation
Bubbles	Length : 3.0 mm - 15.0 mm Width : 1.0 , max.
Scratches	Heavy : 3.0 mm - 15.0 mm long Light : 5.0 mm - 30.0 mm long
Inclusion materials	0.5 mm - 1.5 mm long
Aggregate of above defects	(1) Aggregate of defects of dimension below the corresponding minimum given above may be allowed provided that the visible light transmission is not impaired when tested according to TIS 195. (2) Aggregate of up to 5 defects within allowable limits of size and length given above may be allowed within an arbitrary circle of 300 mm provided that among these there is not more than 1 large defect. Large defects involve the following: Bubbles 10.0 mm - 15.0 mm long Heavy scratches 10.0 mm - 15.0 mm long
Slide	The non-exposed slide shall not exceed 1.5 mm.
Tong mark	Permissible in the area not exceeding 8 mm from the periphery for flat glass. Permissible in the area not exceeding 12 mm from the periphery for curved glass.
Mold mark	Permissible in the area not exceeding 12 mm from the periphery for curved glass.
Crack	Not permissible
Edge chipping	Permissible in the area not exceeding 1.0 mm from the periphery. Unexposed chipping allowed up to the concealing range, none which might be obstacle in use.

5.7 Fragmentation

When tested as in TIS 195, the following shall be complied with:

5.7.1 Peripheral zone

- 5.7.1.1 There shall be not less than 40 fragments nor more than 400 fragments in the embracing square of size 50 x 50 mm.
- 5.7.1.2 There shall be not more than 2 fragments exceeding 3 mm² but not over 5 mm² in area.
- 5.7.1.3 There shall be not more than 5 fragments of length exceeding 75 mm to a maximum of 150 mm.
- 5.7.1.4 If elongated fragment extending to the edge of the specimen forms an angle not less than 45° with it, the length of that fragment shall be less than 60 mm.

5.7.2 Visibility zone

- 5.7.2.1 The aggregate area of fragments of not less than 2 cm² shall represent not less than 15% of a rectangular area of 500 mm x 200 mm, or if the height of the test piece is less than 440 mm, a rectangular area of 500 mm x 150 mm.

- 5.7.2.2 There shall be not more than 3 fragments over 16 cm² but less than 25 cm² within a radius of 100 mm from the point of impact, nor more than 8 in the whole visibility zone.
- 5.7.2.3 There shall be not more than 5 fragments of length exceeding 100 mm to a maximum of 200 mm.
- 5.7.2.4 There shall be not more than 15 fragments exceeding 2 cm² with sharp edges and extending across a circle of 50 mm diameter in any rectangular area of 500 mm x 200 mm.
- 5.7.3 Intermediate zone
Fragmentation in this zone shall have characteristics intermediate between those of the peripheral and the visibility zones.

6. Mark and label

- 6.1 There shall be at least number, letter or mark indicating clearly, legibly and durably the following information at any corner on each pane of zone tempered glass.
 - (1) The term "Zone tempered glass" or "Zoned tempered" or the letter "Z"
 - (2) Grade
 - (3) Name of manufacturer or factory, or registered trade mark
- 6.2 There shall be at least number, letter or mark indicating clearly and legibly the following information on each package.
 - (1) The term "Zone tempered glass" or "Zoned tempered" or the letter "Z"
 - (2) Thickness in millimetres
 - (3) Number of sheets in package
 - (4) Lot code
 - (5) Name of manufacturer or factory, or registered trade mark
- 6.3 In case foreign language is used, the meaning shall correspond to that in Thai specified above.
- 6.4 Any person who manufactures products complying with this standard may use the Standards Mark in connection with his products only after having received a license from the Industrial Product Standards Council.

7. Sampling and criteria for conformity

- 7.1 Lot: zone tempered glasses of the same thickness made from the same material under the same conditions and in the same continuous run which are manufactured or delivered or purchased at one time.
- 7.2 Sampling and acceptance shall comply with the following plan or other technically equivalent plan.
 - 7.2.1 Sampling and acceptance for test on thickness, appearance and visible light transmission
 - 7.2.1.1 Three samples shall be drawn at random from a lot for preparation of the test pieces.
 - 7.2.1.2 Provided all the test pieces comply with the requirements of clauses 3.1, 5.1 and 5.2 that lot shall be deemed to comply with the requirements.
 - 7.2.2 Sampling and acceptance for tests on secondary image separation, distortion of vision and colour identification
 - 7.2.2.1 Four samples shall be drawn at random from a lot as test pieces.
 - 7.2.2.2 Provided all the test pieces comply with the requirements of clauses 5.3, 5.4 and 5.5, that lot shall be deemed to comply with the requirements.

7.2.3 Sampling and acceptance for impact resistance - head form test

7.2.3.1 Sampling

- (1) Where product samples are used as test pieces
Four samples shall be drawn at random from a lot as test pieces.
- (2) Where separate test pieces are prepared
Six test pieces shall be prepared by the same process used in the manufacturing of the product.

7.2.3.2 Acceptance

- (1) Where product samples are used as test pieces
Provided all the test pieces comply with the requirement of clause 5.6, that lot of zone tempered glasses shall be deemed to comply with the requirement.
Failure of more than 1 test piece shall constitute failure of the lot to meet the requirement.
If one test piece fails, 4 more test pieces shall be drawn for retest all of which shall meet the requirement of clause 5.6 for the lot to be deemed in compliance with the requirement.
- (2) Where separate test pieces are prepared
Provided all the test pieces comply with the requirement of clause 5.6, that lot of zone tempered glasses shall be deemed to comply with the requirement.
Failure of more than 1 test piece shall constitute failure of the lot to meet the requirement.
If one test piece fails, 6 more test pieces shall be drawn for retest all of which shall meet the requirement of clause 5.6 for the lot to be deemed in compliance with the requirement.

7.2.4 Sampling and acceptance for fragmentation

7.2.4.1 Six samples shall be drawn at random from a lot.

7.2.4.2 Provided all the test pieces comply with the requirement of clause 5.7, that lot of zone tempered glasses shall be deemed to comply with the requirement.

Failure of more than 2 test pieces shall constitute failure of the lot to meet the requirement.

If 1 test piece fails, 1 more test piece shall be drawn for retest at the same position as the failing one and shall meet the requirement of clause 5.7 for the lot to be deemed in compliance with the requirement.

If 2 test pieces fail, 6 more test pieces shall be drawn for retest all of which shall meet the requirement of clause 5.7 for the lot to be deemed in compliance with the requirement.

7.3 Criteria for conformity

Provided the samples meet all the requirements of clauses 7.2.1.2, 7.2.2.2, 7.2.3.2 and 7.2.4.2, the lot of zone tempered glasses shall be deemed to comply with this standard.