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Laminated glass

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee, as the result of proposal for revision of Japanese Industrial Standard submitted by Flat Glass Manufacturers Association of Japan (FGMAJ)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS R 3205 : 1998** is replaced with this Standard.

This revision has been made based on **ISO 12543-1:1998** *Glass in building—Laminated glass and laminated safety glass—Part 1: Definitions and description of component parts*, **ISO 12543-3:1998** *Glass in building—Laminated glass and laminated safety glass—Part 3: Laminated glass*, **ISO 12543-4:1998** *Glass in building—Laminated glass and laminated safety glass—Part 4: Test methods for durability*, **ISO 12543-5:1998** *Glass in building—Laminated glass and laminated safety glass—Part 5: Dimensions and edge finishing* and **ISO 12543-6:1998** *Glass in building—Laminated glass and laminated safety glass—Part 6: Appearance* for the purposes of making it easier to compare this Standard with International Standards; to prepare Japanese Industrial Standard conforming with International Standards; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Laminated glass

Introduction This Japanese Industrial Standard has been prepared based on the first editions of **ISO 12543-1** *Glass in building—Laminated glass and laminated safety glass—Part 1: Definitions and description of component parts*, **ISO 12543-3** *Glass in building—Laminated glass and laminated safety glass—Part 3: Laminated glass*, **ISO 12543-4** *Glass in building—Laminated glass and laminated safety glass—Part 4: Test methods for durability*, **ISO 12543-5** *Glass in building—Laminated glass and laminated safety glass—Part 5: Dimensions and edge finishing* and **ISO 12543-6** *Glass in building—Laminated glass and laminated safety glass—Part 6: Appearance* published in 1998 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standards have been modified. A list of modifications with the explanations is given in Annex (informative).

1 Scope This Standard specifies the laminated glass⁽¹⁾ to be used mainly for the buildings, windows of ships, furniture and the like.

Note ⁽¹⁾ The laminated glass is that of which two or more material plate glasses have been bonded with entire surfaces by inserting the intermediate membrane, and in case of fracture due to an external force, the larger part of the fragments has been so made as not being scattered. The classes of the material plate glass are given in clause 6. The intermediate membrane is a layer of synthetic resin which interposes between the material plate glasses for the purpose of bonding both together.

Remarks : The International Standards corresponding to this Standard are as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standards and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO 12543-1:1998 *Glass in building—Laminated glass and laminated safety glass—Part 1: Definitions and description of component parts* (MOD)

ISO 12543-3:1998 *Glass in building—Laminated glass and laminated safety glass—Part 3: Laminated glass* (MOD)

ISO 12543-4:1998 *Glass in building—Laminated glass and laminated safety glass—Part 4: Test methods for durability* (MOD)

ISO 12543-5:1998 *Glass in building—Laminated glass and laminated safety glass—Part 5: Dimensions and edge finishing* (MOD)

ISO 12543-6:1998 *Glass in building—Laminated glass and laminated safety glass—Part 6: Appearance* (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS B 1501 *Steel balls for ball bearings*

JIS B 7502 *Micrometer callipers*

JIS B 7512 *Steel tape measures*

JIS B 7516 *Metal rules*

JIS K 6253 *Hardness testing methods for rubber, vulcanized or thermoplastic*

JIS R 3202 *Float glass and polished plate glass*

JIS R 3203 *Patterned glass*

JIS R 3204 *Wired glass*

JIS R 3206 *Tempered glass*

JIS R 3208 *Heat absorbing glass*

JIS R 3212 *Test method of safety glazing materials for road vehicles*

JIS R 3221 *Solar reflective glass*

JIS R 3222 *Heat-strengthened glass*

JIS Z 8401 *Guide to the rounding of numbers*

3 Classification and symbols The laminated glass shall be classified as given in the following, according to the shapes, falling ball impact peeling characteristics and shot bag impact characteristics.

- a) Classification according to the shapes shall be as given in the following:
- 1) Flat laminated glass
 - 2) Curved laminated glass (However, patterned glass, tempered glass and heat-strengthened glass shall not be used as the material plate glass.)
- b) Classes and symbols according to the falling ball impact peeling characteristics and shot bag impact characteristics shall be as given in table 1.

Table 1 Classes and symbols according to characteristics

Class	Symbol	Characteristics
Class I	L I	Flat laminated glass and curved laminated glass which conform to the requirements of 4.6.
Class II-1	L II-1	Among the flat laminated glasses, those which conform to the requirements of 4.6, and 4.7.1 at a falling height of 120 cm.
Class II-2	L II-2	Among the flat laminated glasses, those which conform to the requirements of 4.6, and 4.7.1 at a falling height of 75 cm.
Class III	L III	Flat laminated glass, constituted of two material plate glasses of which total thickness ⁽²⁾ of material plate glasses is 16 mm or under, which conform to the requirements of 4.6 and 4.7.2.

Note (2) The total thickness of material plate glasses shall be the total value (mm) of the numerals of the name of class according to the thickness of material plate glass.

4 Qualities

4.1 Appearance The appearance of the laminated glass shall be subjected to the test in accordance with 7.1, and the results shall conform to the requirements of table 2.

Table 2 Appearance

Item	Appearance
Blister ⁽³⁾	As to the blisters in the intermediate membrane, there shall be no discernible one. However, portions ⁽⁴⁾ not impedimental in use may be omitted.
Foreign substance ⁽³⁾	As to the foreign substances in the intermediate membrane, that of impedimental in use shall not exist.
Fissure	There shall be no fissure.
Chip	That of not less than the thickness of the material plate glass in width or length shall not exist.
Haze and scratch	Those impedimental in use shall not exist.
Wrinkle and streak of intermediate membrane	Those impedimental in use shall not exist.

Notes ⁽³⁾ The blisters and foreign substances in the material plate glass shall be the sum or under the permissible number in **JIS R 3202**, **JIS R 3203** and **JIS R 3204** of the material plate glass.

⁽⁴⁾ The portions which are not impedimental in use may be determined upon agreement between the parties concerned.

4.2 Camber The camber of the flat laminated glass shall be subjected to the measurement in accordance with 7.2, and in the case of the laminated glass of a float glass and polished plate glass, heat absorbing float glass and heat absorbing polished glass, and solar reflective glass (that is constituted of the tempered glass or heat-strengthened glass as the material plate glass shall be omitted) or the laminated glass of only the combination of these are used as the material, the results shall not exceed 0.3 %, and further, in the case of the laminated glass to which the figured glass has been added as the material plate glass the results shall not exceed 0.5 % respectively.

As to the laminated glass using the wired or net glass, tempered glass, heat-strengthened glass or combination of these as the material plate glass, it shall be as agreed between the parties concerned.

4.3 Radiation resistance The radiation resistance of the laminated glass shall be subjected to the test on three specimens in accordance with 7.3, the generation of cracks in the glass portion of the specimens may be permissible, however, there shall not be noticeable discolouration and impedimental blisters, delamination and cloudiness on the place exceeding 15 mm from the rim and exceeding 10 mm from the fissure of the specimen.

In addition, as to the laminated glass which has used the transparent intermediate membrane, the measurement of visible light transmittance shall be carried out on three specimens in accordance with 7.7, and its reduction rate shall be 10 % or under for the specimen of which the initial value is over 20 %. Furthermore, as to the specimen of which the initial value is 20 % or under, its reduction rate shall be 2 % or under.

4.4 Thermal resistance The thermal resistance of the laminated glass shall be subjected to the test on three specimens in accordance with 7.4, the generation of cracks in the glass portion of the specimens may be permissible, however, there shall be neither impedimental blister, delamination and cloudiness nor other defects on the place exceeding 15 mm from the rim and exceeding 10 mm from the fissure of the specimen.

4.5 Humidity resistance The humidity resistance of the laminated glass shall be subjected to the test on three specimens in accordance with 7.5, the generation of cracks in the glass portion of the specimens may be permissible, however, there shall not be impedimental blisters, delamination and cloudiness on the place exceeding 15 mm from the rim and exceeding 10 mm from the fissure of the specimen.

4.6 Falling ball impact peeling characteristics The falling ball impact peeling characteristics of the flat laminated glass being bonded of two material plate glasses shall be subjected to the test on six specimens in accordance with 7.6, and it shall be deemed as acceptable when there is no exposed portion due to cutting or lack of glass in the intermediate membranes of five specimens or more. However, for those of exceeding 16 mm in total thickness of the material plate glass and tempered glass or heat-strengthened glass are used as the material plate glass, this requirement shall not apply.

In the case of exceptional articles from application in the flat laminated glass mentioned above, curved laminated glass and the laminated glass of three material plate glasses or more, it shall be as agreed between the parties concerned.

4.7 Shot bag impact characteristics The shot bag impact characteristics shall be in accordance with the following.

4.7.1 Classes II-1 and II-2 The shot bag impact characteristics of the laminated glass of Class II-1 and Class II-2 shall be subjected to the test on four specimens in accordance with 7.7, and all of the four sheets shall conform to either a) or b) in the following.

- a) When the glass has been broken, an opening through which the ball of 75 mm in diameter passes freely shall not be generated on the broken part.
- b) The glass shall not be broken.

4.7.2 Class III The shot bag impact characteristics of the laminated glass of Class III shall be subjected to the test on four specimens in accordance with 7.7, and both of the two glass plates constituting the laminated glass have been broken, and an opening through which the ball of 75 mm in diameter passes freely shall not be generated.

5 Shapes, dimensions and tolerances

5.1 Shapes, side lengths and thicknesses The shapes and side lengths of the laminated glass shall be as agreed between the parties concerned. The thickness of the laminated glass shall be the total of the thickness of material plate glass and the thickness of intermediate membrane. The dimensional values shall be in mm unit, side length in integer value, and thickness in the numerical value of one place of decimal.

5.2 Tolerances on length of one side The length of one side of the flat laminated glass, as to that of square in shape, the measured value in accordance with the method defined in 7.8 shall be within the range of tolerances given in table 3. However, the tolerances for those of using tempered glass or heat-strengthened glass as the material plate glass, as well as those in accordance with 5.1 and exceeding 24 mm in the total thickness of material plate glass not indicated in table 3, shall be as agreed between the parties concerned. In addition, as to those other than square shape, it shall be as agreed between the parties concerned.

Table 3 Tolerances of length of one side

Unit: mm

Thickness of material plate glass	Tolerances on length of one side		
	Side of 1 200 or under in length	Side of 1 200 or over to and incl. 2 400 in length	Side of 2 400 or over in length
4 or over to and excl. 11	+2 -2	+3 -2	+5 -3
11 or over to and excl. 17	+3 -2	+4 -2	+6 -3
17 or over to and incl. 24	+4 -3	+5 -3	+7 -4

5.3 Tolerances on difference in length between diagonal lines As to the flat laminated glass of which the shape is square, the difference in length between diagonal lines measured in accordance with the method specified in 7.9 shall be within the range of tolerances given in table 4. However, the tolerance for those using tempered glass or heat-strengthened glass and those exceeding 24 mm in the total thickness of material plate glass shall be as agreed between the parties concerned. Furthermore, for those other than square shape, it shall be as agreed between the parties concerned.

Table 4 Tolerances on difference in length between diagonal lines

Unit: mm

Length of long side	Tolerances on difference in length between diagonal lines
2 000 or under	6
2 000 or over to and incl. 3 000	7
3 000 or over	8

5.4 Maximum permissible displacement Displacement of laminated glass means the misalignment of side rims of the material plate glasses in a square-shaped flat laminated glass. It shall be measured according to 7.10 and the results shall not exceed the maximum permissible displacement given in table 5. Displacement limits for laminated glasses of shapes other than square shall be subject to the agreement between the parties concerned.

Table 5 Maximum permissible displacement

Unit: mm

Nominal dimension	Maximum permissible displacement
1 000 or under	2.0
1 000 or over to and incl. 2 000	3.0
2 000 or over to and incl. 4 000	4.0
Over 4 000	6.0

5.5 Tolerances on thickness As to the flat laminated glass, the tolerances for the thickness in accordance with **5.1** of the measured value of the thickness in accordance with **7.11** shall be the sum of the tolerances on the thickness of the material plate glass which has been manufactured by heating and pressurizing using the membranous body formed in advance as the material of the intermediate membrane, and in the case of those which are manufactured by injecting liquid resin and setting it, the tolerance on thickness shall be the total of the tolerance on the thickness of material plate glass and the tolerance on the thickness of intermediate membrane given in table 6.

In addition, as to those of which the thickness of the intermediate membrane of membranous body formed in advance exceeds 2 mm, the tolerance of ± 0.2 mm shall be added to the tolerance of the thickness of material plate glass.

In addition, as to those of the total thickness of material plate glass exceeding 24 mm, and those of using tempered glass or heat-strengthened glass as the material plate glass, they shall be as agreed between the parties concerned.

Table 6 Tolerances on thickness of intermediate membrane in the case where liquid resin is made to set

Unit: mm

Thickness of intermediate membrane	Tolerances
1 or under	± 0.4
1 or over to and excl. 2	± 0.5
2 or over to and excl. 3	± 0.6
3 or over	± 0.7

5.6 Dimension of the curved laminated glass As to the curved laminated glass, the tolerances on dimension of each part defining the shape such as length of side and the like and, the tolerances on thickness as well as the error on curvature shall be as agreed between the parties concerned.

6 Materials The material plate glass to be used for the laminated glass shall generally be those as specified in table 7. However, for the laminated glass of the Class III, the wired or net glass, tempered glass and heat-strengthened glass shall not be used.

Table 7 Material plate glass

Material plate glass	Applicable Japanese Industrial Standard
Float glass and polished plate glass	JIS R 3202
Patterned glass ⁽⁵⁾	JIS R 3203
Wired or net glass	JIS R 3204
Tempered glass	JIS R 3206
Heat absorbing glass	JIS R 3208
Solar reflective glass	JIS R 3221
Heat-strengthened glass	JIS R 3222

Note (5) The patterned glass of deeply carved pattern shall be omitted.

7 Test methods

7.1 Appearance test The appearance test shall be carried out by visual observation under an appropriate lighting, taking the product as the specimen, and from its front side. The dimension of the chip shall be measured by using the metal rule of 0.5 mm in minimum scale value specified in **JIS B 7516**.

7.2 Measurement of camber The product of flat laminated glass shall be taken as the specimen. Stand the specimen vertically, and measure by applying a ruler or a thread stretched in the shape of a straight line horizontally to it. In the case of the bowed shape, it shall be expressed by the percentage of the ratio of the height of arc to the length of chord, and in the case of the corrugated shape, by the percentage of the ratio of the height from the bottom of root to the top of crest to the distance from the crest to crest (or from root to root).

7.3 Radiation resistance test The radiation resistance test shall be carried out as follows:

- a) The specimen of the radiation resistance test shall be that has been cut out from the product or the laminated glass which has been manufactured by the closely resembled method using the same material plate glass and intermediate membrane as the product, and its dimensions approximately 300 mm × 76 mm or approximately 300 mm × 300 mm. When there is a side specified as the outdoor side, the side shall be arranged in the direction of a light source. As to the unsymmetrical laminated glass⁽⁶⁾ without the specified outdoor side, the test shall be performed in both directions. However, as to the symmetrical laminated glass, the test can be represented by the single side.

Note (6) It refers to the laminated glass of which the type of glass or the thickness of glass is not symmetrical in structure from the centre of the laminated glass to the direction of both sides.

- b) The black light which has the quartz glass mercury-vapor lamp of 750 W ± 50 W or the light source equivalent to it and is capable of controlling temperature shall be used, and the specimen shall be put at a distance of 230 mm from the light source with the outdoor side of the specimen faced with the light source in