

Japanese Agricultural Standard for Glued laminated timber

Establishment: Notification No. 1152, september 25, 2007, Ministry of Agriculture, Forestry and Fisheries

Note: This is an unofficial translation, for your reference only.

(Scope of Application)

Article 1. This standard shall apply to any general timber that is made of sawn boards or small squares with their grain direction roughly parallel to one another and glued together in the direction of thickness, width, and length (here after referred to as “glued laminated timber” or “glulam” for short).

(Definitions)

Article 2. In this standard, the terms given in the left column of the following table shall be defined as set forth in the right column of the same table.

Term	Definition
Glued laminated timber for fixtures	Within the glued laminated timber category (glulam), those with unfinished surfaces, those with visible beautifully finished surfaces (including timbers that have undergone secondary adhesion), or those glulams with grooves or other work on the surface or with painted surfaces, which are mainly used for interior fixtures and structures.
Decorative glued laminated timber for fixtures	Among glulams, those with unfinished surfaces veneered for good appearance (including timbers underlaid with (at least one piece of) base board of less than 5 mm thick, to protect veneer, of which grain direction is parallel to that of the veneer, underlaid with at least one piece of veneer not more than 2 mm thick with grain direction perpendicular to that of the existing veneer or underlaid with at least one piece of plywood at least 3 mm thick) or those glulam with grooves or other work on the surface or with painted surfaces, which are mainly used for interior fixtures and structures.
Structural glued laminated timber	Among glulams, those made of graded sawn boards (including those glued and machined widthwise and those glued and joined lengthwise using a scarf joint or finger joint system) that are glued and laminated together so that their grain direction can be parallel to one another (including those timbers that have undergone secondary adhesion or with painted surfaces to protect against corrosion, etc.); these members are prepared to ensure the required strength for load-bearing members of structures (excluding decorative structural glued laminated timber posts).
Decorative structural glued laminated timber post	Among glulams, those that are not only made of graded sawn boards (including those glued and machined widthwise and those glued and joined lengthwise using scarf joints or a finger joint system) that are glued and laminated together, but also prepared with its unfinished surface veneered for good appearance (including those type of timbers underlaid with (at least one piece of) base board no greater than 5 mm thick, to protect veneer, of which grain direction is parallel to that of the veneer, underlaid with at least one piece of veneer (not more than 2 mm in thickness of which grain direction is perpendicular to that of the existing veneer or underlaid with at least one piece of plywood at least 3 mm thick), which are mainly used as columns in the construction of traditional Japanese post and beam structures (limited to members with a cross sectional side at least 90 mm but not more than 135 mm in length).
Short side (Width)	The shorter side in the cross section of a glulam.
Long side (Depth)	The longer side of the cross section of a glulam. However, if the cross section is square, this term refers to the side in the direction of lamination.
Length of timber	The length of the shortest line between a point on one butt end surface of a straight glulam to a point on the other butt end surface of the glulam.
Finished timber	Within the glued laminated timber for fixtures category, those that have been dimensionally finished by corrective cutting or surface machining.
Unfinished timber	Within the glued laminated timber for fixtures category, that has not been dimensionally finished.
Secondary adhesion	Within the glued laminated timber for fixtures category, this term refers to secondary gluing in the length-wise direction using finger joints between different glulams; for structural glued laminated timbers, this term refers to adhesions in the width direction or in the direction of lamination between different glulams that have been manufactured under identical conditions.
Lamina	This term refers to the material from which the glulam is composed or to one of its layers.
Unevaluated width-wise jointed lamina	Among laminae used for structural glued laminated timbers, laminae which is rectangular in shape and joined in the widthwise direction with an adhesive not specified in the “adhesion” section of Article 5 by Use Environment, or laminae that are joined in the widthwise direction without an adhesive.

Large dimension glulam	Within the structural glued laminated timber category, one having a shorter side (width) of not less than 15 cm in length and a cross-sectional area of at least 300 cm ² .
Medium dimension glulam	Within the structural glued laminated timber category, one having a short side (width) of at least 7.5 cm in length and a long side (depth) of at least 15 cm in length and does not otherwise fit in the large dimension category.
Small dimension glulam	Within the structural glued laminated timber category, one having a short side (width) less than 7.5 cm in length and a long side (depth) of less than 15 cm in length.
Mixed-grade composition glued laminated timber	A structural glued laminated timber comprised of laminae of different grades. When used for members requiring high flexural performance such as beams, the direction in which bending stress is applied is perpendicular to the direction of lamination.
Same-grade composition glued laminated timber	A structural glued laminated timber in which laminae are of the same quality. When composed of 2 or 3 laminae and used in an application requiring high flexural performance such as beams, the direction in which the bending stress is applied is parallel to the direction of lamination.
Symmetrical composition	Within the mixed-grade composition glulam, symmetrical members are those in which the quality composition of laminae are positioned symmetrically about the central axis.
Specified symmetrical composition	Within the mixed-grade composition glulam, specified symmetrical members are those in which the quality composition of laminae are positioned symmetrically about the central axis and their bending performance has been prioritized.
Non-symmetrical composition	Within the mixed-grade composition glulam, non-symmetrical members are those in which the quality composition of laminae are positioned asymmetrically about the central axis.
Lamina of outermost layer	Within members of mixed grade composition, the lamina located within the outermost 1/16 of the member depth from either surface in the direction of lamination.
Lamina of outer layer	Within members of mixed grade composition, laminae other than the aforementioned outermost laminae used within a zone greater than 1/16 but less than 1/8 of the member depth from either surface in the lamination direction.
Lamina of inner layer	Within members of mixed grade composition, lamina used within a zone greater than 1/4 the member depth from either surface in the lamination direction.
Lamina of middle layer	Within members of mixed grade composition, one that is other than laminae of the outermost layer, laminae of the outer layer, and laminae of the inner layer.
Grading machine	A device used for measuring the Young's modulus of a lamina.
MSR (Machine Stress Rated) grading	A process for grading laminae whereby a grading machine measures the Young's modulus of the laminae as it is transferred continuously along the production line in the lengthwise direction, and the bending strength or tensile strength of said laminae is verified to complete the grading process.
Machine stress grading	Quality segregation of laminae using a mechanical grading system other than MSR.
Visual stress grading	This grading shall be the classification of lamina quality using lamina visual characteristics without using a grading machine.
Use Environment A	A use environment where the structural glued laminated timber's moisture content will exceed 19% continuously or intermittently; come in direct contact with weather; be exposed to high temperatures from the sun or other similar conditions for long periods; be required to have high adhesion performance even in the event of structural fires; and otherwise be required to have a high level of performance in use environments where load-bearing members for structures must meet the demands for water resistance, weather resistance, and heat resistance.
Use Environment B	A use environment where a structural glued laminated timber will occasionally exceed 19% moisture content; occasionally reach a high temperature by long-term exposure to solar heat or other similar conditions; be required to have the high adhesion performance even in the event of structural fires; and otherwise be required to have a standard level of performance in use environments where load-bearing members for structures must meet the demands for water resistance, weather resistance, and heat resistance.
Use Environment C	A use environment where a structural glued laminated timber will occasionally exceed 19% moisture content; occasionally reach a high temperature by long-term exposure to solar heat or other similar conditions; and otherwise be required to have a standard level of performance in use environments where load-bearing members for structures must meet the demands for water resistance, weather resistance, and heat resistance.

(Standards for Glued Laminated Timber for Fixtures)

Article 3. The standards for glued laminated timbers for fixtures shall be as provided hereunder:

Categories	Standards																
	Grade 1	Grade 2															
Bonding quality	Results of immersion delamination tests specified in Item (1) in Section 3 of the Appendix shall indicate that except for the case of secondary adhesion, the delamination rate for both butt ends' surface is 10% or lower, and the sum of the length of delamination that occurs in the same glue line is not more than one-third of the length of said glue line. In addition, in the case of secondary adhesion, an average delamination rate for the cut surface shall be 10% or lower. Moreover, when two test specimens are used, the average delamination rate shall be the average of the two test specimens. When one test specimen is used, the delamination rate of said test specimen is the average delamination rate .	The same as left															
Moisture content	The results of moisture content tests specified in Item (5) of Section 3 of the Appendix shall indicate that an average of the moisture content of test specimens taken from the same sample glulam is 15% or less.	The same as left															
Formaldehyde emission amount	Regarding the formaldehyde emission test specified in Item (9) in Section 3 of the Appendix, the average value and maximum value of formaldehyde emissions for the sample glulams extracted according to Section 1 of the Appendix shall be less than or equal to the values in the table below depending on the performance class. This shall not apply, however, if a registered certification body or a registered foreign certification body affirms that such sample laminated timber is made with an adhesive that contains no formaldehyde.																
	<table border="1"> <thead> <tr> <th>Performance Class</th> <th>Average value</th> <th>Maximum value</th> </tr> </thead> <tbody> <tr> <td>F☆☆☆☆</td> <td>0. 3mg/L</td> <td>0. 4mg/L</td> </tr> <tr> <td>F☆☆☆</td> <td>0. 5mg/L</td> <td>0. 7mg/L</td> </tr> <tr> <td>F☆☆</td> <td>1. 5mg/L</td> <td>2. 1mg/L</td> </tr> <tr> <td>F☆S</td> <td>3. 0mg/L</td> <td>4. 2mg/L</td> </tr> </tbody> </table>		Performance Class	Average value	Maximum value	F☆☆☆☆	0. 3mg/L	0. 4mg/L	F☆☆☆	0. 5mg/L	0. 7mg/L	F☆☆	1. 5mg/L	2. 1mg/L	F☆S	3. 0mg/L	4. 2mg/L
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Surface Quality	Shall meet Grade 1 "Surface Quality Criteria" set forth in the next section.	Shall meet Grade 2 "Surface Quality Criteria" set forth in the next section.															
Warping (straight timber only), bows and twisting	Deviation from a straight line shall not exceed 1 mm per meter of length of the glulam.	The same as left.															
Painting (timber with markings indicating paint processing only)	Permitted if there are no evident blemishes such as bubbles or irregular paint.	The same as left.															
Grooving, chamfering and cutting works	Well worked.	The same as left.															
Secondary adhesion	Any glued and joined portion between glulams in the length direction shall be of a finger joint system and have enough strength to be used for fixtures. Additionally, the finish of the adhesive shall be satisfactory and shall harmonize with the appearance of the glulam.																
Dimensions	A difference between the marked and the measured dimensions shall be not exceed the values listed in the table below. (Unit: mm)																
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		longer side	Unfinished timber	+3.0	-0
		Length		+ not limited	-0
Marking	Items to be marked	<p>1 The following items shall be marked in block..</p> <p>(1) Product name</p> <p>(2) Name of wood species</p> <p>(3) Visible surface</p> <p>(4) Dimensions</p> <p>(5) Formaldehyde emission amount (except for a case where markings set forth in 2 or 3 are performed)</p> <p>(6) Name of manufacturer or supplier (or importer for the imported products).</p> <p>2 If the product is a coated timber and a registered certification body or registered foreign certification body acknowledges that the product has neither formaldehyde-containing adhesive nor formaldehyde-emitting paint, it may be marked that other than those matters set forth in 1, the product uses non-formaldehyde-containing adhesive and non-formaldehyde emitting paint.</p> <p>3 If the product is not coated and a registered certification body or registered foreign certification body acknowledges that the product has no formaldehyde-containing adhesive and has non-formaldehyde emitting paint, it may be marked that, other than those matters set forth in 1, the product uses non-formaldehyde adhesive.</p>			
	Marking method	<p>1.The items listed from (1) through (5) of the "Items to be marked" section shall be marked as prescribed below:</p> <p>(1) Product name</p> <p>a. Markings for a finished timber product shall state, "Glued laminated timber for fixtures"; markings for unfinished one shall state, "glued laminated timber for fixtures (unfinished)."</p> <p>b. Markings for a coated product shall state, "glued laminated timber for fixtures (coated)."</p> <p>c. For those products made for specific uses, the descriptions of a "glued laminated timber for fixtures," "glued laminated timber for fixtures (coated)," or "glued laminated timber for fixtures (unfinished)" shall be provided and followed by the specified use given in commonly accepted terms in parenthesis, e.g., "(Handrail)".</p> <p>(2) Name of wood species</p> <p>The names of wood species shall be arranged in order of the amount used and shall be indicated by the most common name.</p> <p>(3) Visible surface grade</p> <p>Visible surface grade 1, 2, 3, or 4, whichever is applicable, shall be indicated by letters, numbers, etc.</p> <p>(4) Dimensions</p> <p>Dimensions shall be given in units of millimeters, centimeters, or meters following any of the terms of "Short side," "Long side," and "Length of timber." However, for products which do not have a uniform cross-section through their full length or are molded and thus are difficult to specify their short side or long side, any of these dimensions may be left unmarked for straight timbers, and for other than straight timbers, the indication of "Length of timber" may be left unmarked. In this case, the term of "Short side," "Long side," or "Length of timber" shall be followed by the phrase of "Not applicable."</p> <p>(5) Formaldehyde emission amount</p> <p>A product belonging to the performance class "F☆☆☆☆," "F☆☆☆," "F☆☆," or "F☆S" shall be marked as "F☆☆☆☆," "F☆☆☆," "F☆☆," or "F☆S."</p> <p>2. According to (2) of the preceding section "Items to be marked," if it is indicated that the product uses a non-formaldehyde adhesive and/or non-formaldehyde emitting paint, such product shall be marked as "Non-formaldehyde Adhesive and Non-formaldehyde Emitting Paint Used."</p> <p>3. According to (3) of the preceding section, if it is indicated that the product uses a non-formaldehyde adhesive, such product shall be marked as "Non-formaldehyde Adhesive Used."</p> <p>4. The matters specified in the preceding section shall be marked as prescribed in the Appendix, in a conspicuous place of each piece or unit of glulams.</p>			
	Items prohibited from marking	<p>The matters set forth below shall not be marked:</p> <p>(1) Any term contradictory to the contents of the matter as specified in the preceding section of "Items to be marked," or</p> <p>(2) Letters, pictures or other signs that may induce the misconception of the quality</p>			

2 The quality standards for visible surfaces set forth in the preceding section shall be as provided

Category	Criteria	
	Grade 1	Grade 2

Knots	1 Knots shall be less than 10 mm in the maximum diameter. 2 Knot hole, rotten knot or loose knot shall not be permitted.	1 Knots shall be less than 30 mm in the maximum diameter 2 Knot holes, rotten knots or loose knots shall not be permitted.
Resin pocket, resin streak, and bark	Permitted if very slight.	Permitted if slight.
Chips and flaws	Permitted if very slight.	Chips shall be 2 mm or less in thickness, 3 mm or less in width, 50 mm or less in length. No more than one chip is permitted.
Decay	Not permitted.	Permitted if the decay does not reach the woody part or is not perceptible enough to change the hardness of the wood and the decayed area is minimum.
Splits	Permitted if very slight.	Permitted if slight.
Discoloration and stains	Permitted if very slight.	Permitted if not conspicuous.
Holes	Permitted if very slight.	Permitted if not conspicuous.
Rough grain (Chipped grain)	Permitted if very slight.	Permitted if not conspicuous.
Open joints	Permitted if very slight.	Permitted if not conspicuous.
Repairs	Permitted if the color or grain matches the surrounding surface well, and the repaired area is flush with adjacent areas and is free of loose particles or indentations.	Permitted if the repaired area is flush with adjacent areas and is free of loose particles or indentations.
Other defects	Permitted if very slight.	Permitted if not conspicuous.

(Note) 1 Any knot or repaired area within a groove cut on the surface of a glulam shall not be deemed as a defect unless it affects the appearance of the product.

2 The term "repair" shall refer to patching, plugging, or filling with synthetic resin, etc.

(Standards for Decorative Glued Laminated Timber for Fixtures)

Article 4. The standards for decorative glued laminated timbers for fixtures shall be as provided hereunder:

Category	Criteria										
	Grade 1	Grade 2									
Quality	Bonding quality	Results of the immersion delamination test specified in Item (1) of Section 3 of the Appendix shall indicate that the delamination rate for both butt end surfaces is 10% or lower, and the sum of the length of delamination that occurs in a single glue line is not more than one-third of the length of said glue line.	The same as left								
	Moisture content	The results of moisture content test specified in Item (5) of Section 3 of the Appendix shall indicate that the average moisture content of the test specimens taken from the same sample glulam is 15% or lower.	The same as left								
	Resistance to surface check	The results of tests for "Resistance to Surface Check" specified in Item (6) of Section 3 of the Appendix shall indicate that no cracks occur on the surface of the test specimen, or if cracks develop, they are minimal.	The same as left								
	Formaldehyde emission amount	The same as specified in the table of Section 1 "Formaldehyde emission amount" of the preceding Article.	The same as left								
	Quality of visible surfaces	Shall meet Grade 1 criteria noted in the "Standards for the Quality of Visible Surfaces" set forth in the next section.	Shall meet Grade 2 criteria noted in the "Standards for the Quality of Visible Surfaces" set forth in the next section.								
	Painting (timber with markings indicating paint processing only)	Permitted if there are no blemishes evident such as bubbles or irregular paint.	The same as left								
	Warping (straight timber only), bow and twist	The deviation from a straight line shall be less than 1 mm per meter of length of the glulam. However, for warping of door headers and door sills, the deviation from a straight line shall be less than 3 mm per meter of length of the glulam.	The same as left								
	Grooving, chamfering and cutting works	Well worked.	The same as left								
	Thickness of decorative veneer	1. Shall be not less than 1.5 mm for door sills, stiles, and the top of a stair surface. 2. Shall be not less than 1.2 mm for posts. 3. For products other than door sills, stiles, the top of a stair surface, and posts decorative veneer shall be not less than 0.6 mm thick.	The same as left								
	Dimensions	A difference between the marked and the measured dimensions shall be not less than the values listed in the table below. (Unit: mm)									
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Length	+not limited	-0									

Marking	Items to be marked	<p>1. The following items shall be marked in block.</p> <p>(1) Product Name</p> <p>(2) Name of wood species (core material)</p> <p>(3) Name of wood species (decorative veneer)</p> <p>(4) Thickness of decorative veneer</p> <p>(5) Visible surface</p> <p>(6) Dimensions</p> <p>(7) Formaldehyde emission amount (except for cases where marking set forth in 2 or 3 is performed)</p> <p>(8) Name of manufacturer or supplier (or importer for the imported products).</p> <p>2. Shall be the same as (2) of the section “Matters to be marked” specified in the Table in Section 1 of the preceding article.</p> <p>3. Shall be the same as (3) of the section “Matters to be marked” specified in the Table in Section 1 of the preceding article.</p>
	Marking method	<p>1. The items listed from (1) through (7) of Section “Items to be marked” shall be marked as prescribed below:</p> <p>(1)Product Name</p> <p>a “decorative glued laminated timber for fixtures” shall be indicated on the product;</p> <p>b Markings coated timber products shall state “decorative glued laminated timber for fixtures (coated)”;</p> <p>c For those products made for specific uses, the descriptions “decorative glued laminated timber for fixtures,” or “decorative glued laminated timber for fixtures (coated)” shall be provided and followed by the specified use given in commonly accepted terms in parenthesis, e.g., “(Horizontal Member)”.</p> <p>(2) Name of wood species (core material)</p> <p>The names of wood species shall be arranged in order of the amount used and shall be given by the most common name.</p> <p>(3) Name of wood species (decorative veneer)</p> <p>The names of wood species shall be given by the most common name.</p> <p>(4) Thickness of decorative surface veneer</p> <p>The thickness of the surface veneer shall be given in millimeters to one decimal point.</p> <p>(5) Visible surfaces grade</p> <p>Visible surface grade 1, 2, 3, or 4, whichever is applicable, shall be indicated by letters, numbers, etc.</p> <p>(6) Dimensions</p> <p>Dimensions shall be given in units of millimeters, centimeters, or meters following any of the terms of “Short side,” “Long side,” and “Length of timber.” However, for products which do not have a uniform cross-section through their full length or are molded and thus is difficult to indicate their short side or long side, any of these dimensions may be left unmarked for straight timbers, and for other than straight timbers, the indication of “Length of timber” may be left unmarked. In this case, the terms “Short side,” “Long side,” or “Length of timber” shall be followed by the phrase “Not applicable.”</p> <p>(7) Shall be the same as (1)–(5) of the section “Marking method” specified in the Table in Section 1 of the preceding Article.</p> <p>2. Shall be the same as (2) of the section “Marking method” specified in the Table in the Section 1 of the preceding Article.</p> <p>3. Shall be the same as (3) of the section “Marking method” specified in the Table in the Section 1 of the preceding Article.</p> <p>4. The matters specified in the section of “Items to be marked” shall be marked as prescribed in the Appendix, in a conspicuous place on each piece or unit of glulams.</p>
	Items prohibited from marking	The same as the section “Items prohibited from marking” in Section 1 of the preceding Article.

2. The quality standards for visible surfaces set forth in the preceding section shall be as provided

Category	Criteria	
	Grade 1	Grade 2
Knots	Not permitted.	<p>1 Knots shall have maximum diameter of 30mm and shall not severely affect the appearance of the product.</p> <p>2 Knot holes, rotten knots or loose knots are not permitted.</p>

Resin pocket, resin streak, and bark	Permitted if very slight.	Permitted if slight.
Chips and flaws	Not permitted.	Chips shall be 2 mm or less in thickness, 3 mm or less in width, 50 mm or less in length. No more than one chip is permitted. Slight flaws may be permitted.
Decay	Not permitted.	Permitted if the decay does not cause the wood to reach a point of failure or is not perceptible enough to change the hardness of the wood, and the decayed area is
Splits	Not permitted.	Permitted if slight.
Discoloration and stains	Permitted if very slight.	Permitted if not conspicuous.
Holes	Not permitted.	Permitted if the hole diameter(s) do not exceed 2mm in combination.
Rough grain (Chipped grain)	Not permitted.	Permitted if slight.
Blister, wrinkle and overlap	Not permitted.	Permitted if very slight.
Open joints of veneer	Not permitted.	Permitted up to a gap width of 0.3 mm.
Inconformity of color and grain	Permitted if the colors and the grain directions of the visible surface roughly harmonize with one another.	The same as left.
Repair	Permitted if the repaired area is small, the color or grain is well matched with the surrounding surface, and the repaired area is flush with adjoining areas and is free of loose particles or indentations.	Permitted if the color or grain matches well with the surrounding surface, and the repaired area is free of loose particles or indentations.
Other defects	Permitted if very slight.	Permitted if not conspicuous.

(Note) Shall be the same as (Note) set forth in the "quality standards for visible surfaces" of the preceding section "Standard for Glued Laminated Timber for Fixtures."

(Standards for Structural Glued Laminated Timber)

Article 5. The standards for structural glued laminated timbers shall be as provided hereunder:

Category	Criteria																									
Product quality	<p>The entire adhesion layer (glue line area) shall be uniformly glued and meet the requirements specified in the following Items of (1), (2), and (4), or Items (3) and (4).</p> <p>(1) Results of immersion delamination tests specified in Item (1) of Section 3 of Appendix shall indicate that the delamination rate for both butt end surfaces is 5% or lower, and the sum of the length of delamination that occurs in the same glue line is not more than one fourth of the length of said glue line.</p> <p>(2) Results of boiling water delamination tests specified in Item (2) of Section 3 of the Appendix shall indicate that the delamination rate for both butt end surfaces is 5% or lower, and the sum of the length of delamination that occurs in the same glue line is not more than one fourth of the length of said glue line.</p> <p>(3) The results of the vacuum-pressure delamination test specified in Item (3) of Section 3 of the Appendix shall indicate that the delamination rate for both butt end surfaces is 5% or lower, and the sum of the length of delamination that occurs in the same glue line is not more than one fourth of the length of said glue line.</p> <p>(4) Results of the block shear test specified in Item (4) of Section 3 of the Appendix shall indicate that both the shear strength and the wood failure rate meet or exceed the values listed in the table below. However, if either the shear strength or the wood failure rate for a test piece equals or exceeds the values in the table below, but the other parameter does not, the test may be performed again on the glue line in question.</p> <table border="1" data-bbox="448 887 1347 1879"> <thead> <tr> <th data-bbox="448 887 539 1048">Wood species group number</th> <th data-bbox="539 887 1050 1048">Wood species group</th> <th data-bbox="1050 887 1198 1048">Shear strength (MPa or N/mm²)</th> <th data-bbox="1198 887 1347 1048">Wood failure ration (%)</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 1048 539 1171">1</td> <td data-bbox="539 1048 1050 1171">Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Apiton (Dipterocarpus spp.)</td> <td data-bbox="1050 1048 1198 1171">9.6</td> <td data-bbox="1198 1048 1347 1171" rowspan="2">60</td> </tr> <tr> <td data-bbox="448 1171 539 1238">2</td> <td data-bbox="539 1171 1050 1238">Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana)</td> <td data-bbox="1050 1171 1198 1238">8.4</td> </tr> <tr> <td data-bbox="448 1238 539 1473">3</td> <td data-bbox="539 1238 1050 1473">Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga), White cypress pine (Callitris glauca)</td> <td data-bbox="1050 1238 1198 1473">7.2</td> <td data-bbox="1198 1238 1347 1473" rowspan="3">65</td> </tr> <tr> <td data-bbox="448 1473 539 1597">4</td> <td data-bbox="539 1473 1050 1597">Tsuga (Tsuga sieboldii), Alaskan yellow cedar (Chamaecyparis nootkatensis), Radiata pine (Pinus radiata), Western Hemlock (Tsuga heterophilla)</td> <td data-bbox="1050 1473 1198 1597">6.6</td> </tr> <tr> <td data-bbox="448 1597 539 1809">5</td> <td data-bbox="539 1597 1050 1809">Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), True firs (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contorta), Ponderosa pine (Pinus ponderosa), Scotch pine (Pinus sylvestris), Jack pine (Pinus banksiana), Luan (Parashorea, Pentacme, Shorea spp.)</td> <td data-bbox="1050 1597 1198 1809">6.0</td> </tr> <tr> <td data-bbox="448 1809 539 1879">6</td> <td data-bbox="539 1809 1050 1879">Sugi (Cryptomeria japonica), Western red cedar (Thuja plicata)</td> <td data-bbox="1050 1809 1198 1879">5.4</td> <td data-bbox="1198 1809 1347 1879">70</td> </tr> </tbody> </table>	Wood species group number	Wood species group	Shear strength (MPa or N/mm ²)	Wood failure ration (%)	1	Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Apiton (Dipterocarpus spp.)	9.6	60	2	Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana)	8.4	3	Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga), White cypress pine (Callitris glauca)	7.2	65	4	Tsuga (Tsuga sieboldii), Alaskan yellow cedar (Chamaecyparis nootkatensis), Radiata pine (Pinus radiata), Western Hemlock (Tsuga heterophilla)	6.6	5	Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), True firs (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contorta), Ponderosa pine (Pinus ponderosa), Scotch pine (Pinus sylvestris), Jack pine (Pinus banksiana), Luan (Parashorea, Pentacme, Shorea spp.)	6.0	6	Sugi (Cryptomeria japonica), Western red cedar (Thuja plicata)	5.4	70
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6	Sugi (Cryptomeria japonica), Western red cedar (Thuja plicata)	5.4	70																							
Moisture content	The results of the moisture content test specified in Item (5) of Section 3 of the Appendix shall indicate that an average of the moisture content of test specimens taken from the same sample glulam is 15% or less.																									
Bending performance	The results of bending test A specified in (a) of Item (7) of Section 3 of the Appendix shall indicate that the requirements set forth in (1) through (3) below are satisfied.																									

(only for those marked as “Bending Test was Conducted”)

(1) The average Young’s modulus of bending value for sample glulams, test specimens or model specimens taken from one lot according to Section 1 of the Appendix shall be not less than the value listed in the “Average value” column of Table 1 that corresponds to one of the grades (which corresponds to the grade of the glulam tested) listed in the “Strength grade” column of the same table.

(2) Not less than 95% of the “Young’s modulus of bending” values for sample glulams, test specimens or model specimens taken from one lot according to Section 1 of the Appendix shall be less than the value listed in the “Minimum value” column of Table 1 that corresponds to one of the grades (which corresponds to the grade of the glulam tested) listed in the “Strength grade” column of the same table.

(3) Not less than 95% of the “Bending strength” values for sample glulams, test specimens or model specimens taken from one lot according to Section 1 of the Appendix shall be less than the value obtained by multiplying the value listed in the “Bending strength” column of Table 1 that corresponds to one of the grades (which corresponds to the grade of the glulam tested) listed in the “Strength grade” column of the same table (for test specimens from the compression side of a mixed-grade composition non-symmetrical glulam, the corresponding value listed in Table 2), by the coefficient listed in the right column of Table 3 (for mixed-grade composition glued laminated timbers) or Table 4 (for same-grade composition glued laminated timbers) that corresponds to an applicable class listed in the same table.

Table 1

	Number of layers	Strength grade	Young’s modulus of bending		Bending strength (MPa or N/mm ²)
			Average value	Minimum value	
Mixed-grade composition glulam (symmetrical composition)		E170–F495	17.0	14.0	49.5
		E150–F435	15.0	12.5	43.5
		E135–F375	13.5	11.5	37.5
		E120–F330	12.0	10.0	33.0
		E105–F300	10.5	9.0	30.0
		E 95–F270	9.5	8.0	27.0
		E 85–F255	8.5	7.0	25.5
		E 75–F240	7.5	6.5	24.0
		E 65–F225	6.5	5.5	22.5
		E 65–F220	6.5	5.5	22.0
		E 55–F200	5.5	4.5	20.0
Specified mixed-grade composition glulam	4 or more layers	ME120–F330	12.0	10.0	33.0
		ME105–F300	10.5	9.0	30.0
		ME 95–F270	9.5	8.0	27.0
		ME 85–F255	8.5	7.0	25.5
Mixed-grade composition glulam (non-symmetrical composition)		E160–F480	16.0	13.5	48.0
		E140–F420	14.0	11.5	42.0
		E125–F360	12.5	10.5	36.0
		E110–F315	11.0	9.0	31.5
		E100–F285	10.0	8.5	28.5
		E 90–F255	9.0	7.5	25.5
		E 80–F240	8.0	6.5	24.0
		E 70–F225	7.0	6.0	22.5
		E 60–F210	6.0	5.0	21.0
		E 60–F205	6.0	5.0	20.5
		E 50–F170	5.0	4.5	17.0
Same-grade composition glulam	4 or more layers	E190–F615	19.0	16.0	61.5
		E190–F615	17.0	14.0	54.0
		E150–F465	15.0	12.5	46.5
		E135–F405	13.5	11.5	40.5
		E120–F375	12.0	10.0	37.5
		E105–F345	10.5	9.0	34.5
		E 95–F315	9.5	8.0	31.5
		E 85–F300	8.5	7.0	30.0
		E 75–F270	7.5	6.5	27.0
		E 65–F255	6.5	5.5	25.5
		E 55–F225	5.5	4.5	22.5
		3 layers	E190–F555	19.0	16.0
		E170–F495	17.0	14.0	49.5

rs	E150-F435	15.0	12.5	43.5
	E135-F375	13.5	11.5	37.5
	E120-F330	12.0	10.0	33.0
	E105-F300	10.5	9.0	30.0
	E 95-F285	9.5	8.0	28.5
	E 85-F270	8.5	7.0	27.0
	E 75-F255	7.5	6.5	25.5
	E 65-F240	6.5	5.5	24.0
	E 55-F225	5.5	4.5	22.5
2 laye rs	E190-F510	19.0	16.0	51.0
	E170-F450	17.0	14.0	45.0
	E150-F390	15.0	12.5	39.0
	E135-F345	13.5	11.5	34.5
	E120-F300	12.0	10.0	30.0
	E105-F285	10.5	9.0	28.5
	E 95-F270	9.5	8.0	27.0
	E 85-F255	8.5	7.0	25.5
	E 75-F240	7.5	6.5	24.0
	E 65-F225	6.5	5.5	22.5
	E 55-F200	5.5	4.5	20.0

Table 2

	Strength grade	Bending strength (MPa or N/mm ²)
Mixed-grade composition glulam (non- symmetrical)	E160-F480	34.5
	E140-F420	28.5
	E125-F360	25.5
	E110-F315	24.0
	E100-F285	22.5
	E 90-F255	21.0
	E 80-F240	19.5
	E 70-F225	18.0
	E 60-F210	16.5
	E 60-F205	16.0
	E 50-F170	14.0

Table 3

The depth of the glulam, test specimen or model specimen of mixed-grade composition glulam (mm)	Coefficient
Up to 100	1.13
More than 100 Up to 150	1.08
More than 150 Up to 200	1.05
More than 200 Up to 250	1.02
More than 250 Up to 300	1.00
More than 300 Up to 450	0.96
More than 450 Up to 600	0.93
More than 600 Up to 750	0.91
More than 750 Up to 900	0.89
More than 900 Up to 1050	0.87
More than 1050 Up to 1200	0.86
More than 1200 Up to 1350	0.85
More than 1350 Up to 1500	0.84
More than 1500 Up to 1650	0.83
More than 1650 Up to 1800	0.82
More than 1800	0.80

Table 4

The depth of the sample glulam, test specimen or model specimen of same-grade composition glulam (mm)	Coefficient
100以下	1.00
100超 150以下	0.96
150超 200以下	0.93
200超 250以下	0.90
250超 300以下	0.89
300超	0.85

Formaldehyde emission amount (only for those marked with a formaldehyde emission amount)	Regarding the results of the formaldehyde emission test specified in Item (9) of Section 3 of the Appendix, the average value and maximum value of formaldehyde emissions of the sample glulams collected according to Section 1 of the Appendix shall be less than or equal to the following values listed by emission category.															
	<table border="1"> <thead> <tr> <th>Category Indicated</th> <th>Average value</th> <th>Maximum value</th> </tr> </thead> <tbody> <tr> <td>Those marked with F☆☆☆☆</td> <td>0.3mg/L</td> <td>0.4mg/L</td> </tr> <tr> <td>Those marked with F☆☆☆</td> <td>0.5mg/L</td> <td>0.7mg/L</td> </tr> <tr> <td>Those marked with F☆☆</td> <td>1.5mg/L</td> <td>2.1mg/L</td> </tr> <tr> <td>Those marked with F☆S</td> <td>3.0mg/L</td> <td>4.2mg/L</td> </tr> </tbody> </table>	Category Indicated	Average value	Maximum value	Those marked with F☆☆☆☆	0.3mg/L	0.4mg/L	Those marked with F☆☆☆	0.5mg/L	0.7mg/L	Those marked with F☆☆	1.5mg/L	2.1mg/L	Those marked with F☆S	3.0mg/L	4.2mg/L
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Those marked with F☆S	3.0mg/L	4.2mg/L														
Lamina quality (excluding those with an indication that bending performance tests have been performed)	Shall meet the “Standards for Lamina Quality” set forth in the next section.															
Lamina lay-up quality	Shall conform to the quality criteria for lamina lay-up specified in Section 3.															
Number of lamina	1. Shall be 4 lamina or more for a mixed-grade composition glulam. 2. Shall be 2 lamina or more for a same-grade composition glulam.															
Quality of surface	Shall conform to member surface quality criteria for Type 1, 2 or 3 set forth in Section 4.															
Painting finish (limited to those marked “Painted”)	Blisters and other blemishes shall be indistinguishable.															
Warping (straight timbers only)	The deviation from a straight line shall not exceed 1 mm per meter of length of the structural glulam.															
Bows and twisting	Bows and twisting															
Minimum radius of curvature of curved member (excluding straight)	Shall meet the “Standards for the Minimum Radius of Curvature of the Curved Part” set forth in Section 5.															
Spacing of end joints in adjacent laminae (limited to members having jointed lamina in adjacent layers)	Shall meet the “Standards for the spacing between the Longitudinal Joints of Adjacent Laminae” set forth in Section 6.															
Quality of edge joined lamina	With the exception of non-glued edge joined lamina, edge glued lamina shall meet the requirements set forth in the “Bonding quality” section.															
Location where unevaluated edge joined lamina are used	This provision shall be only applicable to lamina in the inner layer and middle layer of mixed composition glulam (limited to large dimension glulams), where it is apparent load is applied in the direction of lamination. Edge joined lamina shall be limited to one for each lamina. Edge joint gaps shall be limited to 6 mm. In addition, if edge joined lamina are in adjacent layers, the edge joints shall be spaced a minimum distance equal to the thickness of the lamina.															
Finishing of secondary glue lines	Members of the same type may be glued together in a secondary process if the same conditions used during the manufacture process are followed. The finish of the secondary glue line shall have a good appearance and the appearance of the joined glulam shall compliment each other.															

Thickness of lamina	<p>1. A lamina shall be not more than 5 cm in thickness, in principle, have a uniform thickness, and be symmetric around the central axis thereof after finishing processes are completed. However, for a glulam of which strength has been checked by simulation calculations associated with an actual-size strength test or a validity test for the glulam, the thickness shall be not more than 6 cm.</p> <p>2. The thickness of a lamina for outermost layer after the finishing processes are completed shall be not less than 80% of the thickness of a lamina for other layers with a uniform thickness. However, for a same-grade composition glulam and a mixed-grade composition glulam of which strength has been checked by simulation calculations associated with an actual-size strength test or a validity test for the glulam, the thickness may be more than or equal to two-thirds of the thickness of the thickest lamina in the composition layer.</p>																									
Adhesives	<p>1. An adhesive with markings of "Use Environment A" shall be any of the resins below that can satisfy the required performance as defined in Article 2 or shall have a performance equivalent to or higher than that of these resins.</p> <p>(1) Adhesives used for gluing or secondary gluing in the lamination direction or the width direction: Resorcinol resins and resorcinol phenol resins</p> <p>(2) Adhesives used for gluing finger joints or scarf joints: Resorcinol resins, resorcinol phenol resins, and melamine resins</p> <p>2. An adhesive with markings of "Use Environment B" shall be any of the resins below that can satisfy the required performance as defined in Article 2 or shall have a performance equivalent to or higher than that of these resins.</p> <p>(1) Adhesives used for gluing or secondary gluing in the lamination direction or the width direction: Resorcinol resins and resorcinol phenol resins</p> <p>(2) Adhesives used for gluing finger joints or scarf joints: Resorcinol resins, resorcinol phenol resins, and melamine resins</p> <p>3. An adhesive with markings of "Use Environment C" shall be any of the resins below that can satisfy the required performance as defined in Article 2 or shall have a performance equivalent to or higher than that of these resins.</p> <p>(1) Adhesives used for gluing or secondary gluing in the lamination direction or the width direction: Resorcinol resins, resorcinol phenol resins, and water-based polymer-isocyanate resins (shall be those that satisfy the performance of "Class 1, No.1" set forth in Japanese Industrial Standards (hereinafter referred to as "JIS") K 6806. The same shall apply hereunder.)</p> <p>(2) Adhesives used for gluing finger joints or scarf joints: Resorcinol resins, resorcinol phenol resins, water based polymer-isocyanate resins, melamine resins, and melamine-urea copoly-condensation resins</p>																									
Dimensions	<p>The difference between the marked and measured dimensions shall be not more than the value specified in the table below.</p> <table border="1" data-bbox="448 1491 1350 1865"> <thead> <tr> <th colspan="2">Categories</th> <th colspan="2">Difference between the marked and measured</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Shorter side</td> <td>Large dimension</td> <td colspan="2">$\pm 1.5\text{mm}$</td> </tr> <tr> <td>Medium dimension and small dimension</td> <td>+1.5mm</td> <td>-0.5mm</td> </tr> <tr> <td rowspan="3">Longer side</td> <td>Large dimension</td> <td colspan="2">$\pm 1.5\%$(Less than $\pm 5\text{mm}$)</td> </tr> <tr> <td rowspan="2">Medium dimension and small dimension</td> <td>Not more than 300 mm</td> <td>+1.5mm -0.5mm</td> </tr> <tr> <td>More than 300 mm</td> <td colspan="2">$\pm 0.5\%$(Less than +5.0 mm, -3.0 mm)</td> </tr> <tr> <td colspan="2"></td> <td colspan="2">$\pm 5\text{mm}$</td> </tr> </tbody> </table>	Categories		Difference between the marked and measured		Shorter side	Large dimension	$\pm 1.5\text{mm}$		Medium dimension and small dimension	+1.5mm	-0.5mm	Longer side	Large dimension	$\pm 1.5\%$ (Less than $\pm 5\text{mm}$)		Medium dimension and small dimension	Not more than 300 mm	+1.5mm -0.5mm	More than 300 mm	$\pm 0.5\%$ (Less than +5.0 mm, -3.0 mm)				$\pm 5\text{mm}$	
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Marking	<p>Items to be marked</p> <ol style="list-style-type: none"> 1. The following items shall be marked in block. <ol style="list-style-type: none"> (1) Product name (2) Strength grade (3) Surface quality (4) Bonding performance (5) Species name (6) Dimensions (7) Number of lamina's layers (limited to members with veneer finish) (8) Inspection method (only for those which undergo "bending test A" specified in (a) of Item (7) of Section 3 of the Appendix) (9) Name of manufacturer or supplier (or importer for the imported products). 2. Except for posts or other applications that require high compressive strengths, not only items set forth in provision 1 above the application method shall be indicated. 3. Where edge jointed lamina are used, not only items set forth in provisions 1 and 2 above but also the zone within the glulam where edge jointed lamina are used shall be indicated. 4. For a glulam with markings of its formaldehyde emission amount, not only items set forth in the above provisions 1 through to 3 but also marking signs for formaldehyde emission amount shall be collectively indicated. 5. A glulam of which strength has been checked by simulation calculations associated with an actual-size strength test or a validity test, as specified in 5 of (Note) of the table in Item (1)-b. of Paragraph 3. of the "Thickness of lamina" section or in 1 of (Note) of the table in Item (2)-b. of the same section, and in 5 of (Note) of the table in Item (3)-b. of the same section, shall have markings of not only items set forth in the above provisions 1 through to 4 but also an indication that simulation calculations have been performed along with actual-size strength tests or verification tests. 6. A glulam of which strength has been checked by a proof loader, as specified in (Note) of the table of Section 6, shall have markings of not only items set forth in the above provisions 1 through to 5 but also an indication that the strength checks have been implemented by a proof loader. 7. A coated glulam, if a registered certification body or a registered foreign certification body affirms that such glulam does not contain formaldehyde-containing adhesives nor formaldehyde emitting paints, shall have markings of not only items set forth in the above provisions 1 through to 6 but also an indication that non-formaldehyde adhesives and non-formaldehyde emitting paints are contained. 8. A uncoated glulam, if a registered certification body or a registered foreign certification body affirms that such glulam does not contain formaldehyde-containing adhesives nor formaldehyde emitting paints, shall have markings of not only items set forth in the above provisions 1 through to 6 but also an indication that non-formaldehyde adhesives are contained.
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Marking method	<p>1. The items listed from (1) through (8) of the “Items to be marked” section shall be marked as prescribed below:</p> <p>(1) Product name</p> <p>a. Markings for a mixed-grade composition glulam with a symmetrical composition (hereinafter referred to as “mixed-grade composition glulam (symmetrical)”) shall state “mixed-grade composition glulam (symmetrical composition)” and, among such glulams, for those with a specified symmetrical composition, markings for the glulam shall state “mixed-grade composition glulam (specified symmetrical composition).” Among mixed-grade composition glulams, for those with a non-symmetrical composition (hereinafter referred to as “mixed-grade composition glulam (non-symmetrical)”), markings shall state “mixed-grade composition glulam (non-symmetrical composition).” Markings for a same-grade composition glulam shall state “same-grade composition glulam.”</p> <p>b. Markings for a large dimension glulam, a medium dimension glulam, and a small dimension glulam shall state “Large Cross-section,” “Medium Cross-section,” and “Small Cross-section,” respectively.</p> <p>c. For those intended to be used for the specific part of a structure, the description of such part of the structure shall be given in commonly accepted terms in parenthesis, e.g., “(roof truss),” “(beam),” and “(post).”</p> <p>(2) Strength Grade</p> <p>Markings shall state any of the strength grades set forth in the Appended Table.</p> <p>(3) Quality of Surface</p> <p>Markings shall state “Type 1,” “Type 2,” or “Type 3.”</p> <p>(4) Bonding Performance</p> <p>Markings shall state “Use Environment A,” “Use Environment B,” or “Use Environment C.”</p> <p>(5) Name of Wood Species</p> <p>The name of wood species shall be given by the most common name. However, if multiple wood species have been used, markings shall state “name of wood species” (outermost layer), “name of wood species” (outer layer), “name of wood species” (middle layer), and “name of wood species” (inner layer). In addition, if the same wood species is found in various layers, markings shall state such relevant layers collectively.</p> <p>(6) Dimensions</p> <p>Dimensions shall be given in units of millimeters, centimeters, or meters following any of the terms of “Shorter side,” “Longer side,” and “Length of timber” (for other than straight timbers, such terms shall be limited to “Shorter side” and “Longer side”).</p> <p>(7) Number of Lamina Layers</p> <p>Marking shall state the number of lamina layers.</p> <p>(8) Inspection Method</p> <p>For those that undergo the “bending test A” specified in (a) of Item (7) of Section 3 of</p>
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	<p>the Appendix, markings shall indicate that bending strength tests have been performed.</p> <p>2. According to (2) of the "Items to be marked" section, if the direction of use is marked, markings shall be given in a conspicuous place on the upper surface (shall refer to a surface to which loads are applied. (The same shall apply hereunder.), which indicate that such a surface is the top surface.</p> <p>3. According to (3) of the "Items to be marked" section, if unevaluated widthwise jointed lamina is used, indications shall be given following the matters of "Name of the product" that include "(Unevaluated edge jointed lamina used: middle layer)," "(Unevaluated edge jointed lamina used: inner layer)," or "(Unevaluated edge jointed lamina is used: middle/inner layer)." In addition, markings shall be in accordance with (2) of the Matters to be marked" section.</p> <p>4. According to (4) "Items to be marked", if any of the signs for indicating formaldehyde emission levels are marked, said indications shall be as specified in the following provisions (1) through (4):</p> <p>(1) Mark as "F☆☆☆☆" (limited to instances when the formaldehyde emission level is indicated) when the results of the formaldehyde emission test, specified in Item (9) of Section 3 of the Appendix, indicate that formaldehyde emission amount corresponds to the criteria listed in the column for F☆☆☆☆.</p> <p>(2) Mark as "F☆☆☆" (limited to instances when the formaldehyde emission level is indicated) when the results of the formaldehyde emission test, specified in Item (9) of Section 3 of the Appendix, indicate that formaldehyde emission amount corresponds to the criteria listed in the column for F☆☆☆.</p> <p>(3) Mark as "F☆☆" (limited to instances when the formaldehyde emission level is indicated) when the results of the formaldehyde emission test, specified in Item (9) of Section 3 of the Appendix, indicate that formaldehyde emission amount corresponds to the criteria listed in the column for F☆☆.</p> <p>(4) Mark as "F☆S" (limited to instances when the formaldehyde emission level is indicated) when the results of the formaldehyde emission test, specified in Item (9) of Section 3 of the Appendix, indicate that formaldehyde emission amount corresponds to the criteria listed in the column for F☆S.</p> <p>5. According to (5) of the "Items to be marked" section, a glulam whose strength has been checked by simulation calculations associated with full scale strength test or a validity test shall have markings indicating "Strength has been checked by simulation calculations along with full scale bending tests" when full scale bending tests have been performed, "Strength has been checked by simulation calculations along with verification tests" when verification tests have been performed, or "Strength has been checked by full scale bending tests" when there is no need of simulation calculations along with verification tests.</p> <p>6. According to (6) of the "Items to be marked" section, if a glulam needs an indication that the strength has been checked by a proof loader, said glulam shall have markings indicating "The strength checks have been conducted by a proof loader."</p> <p>7. When as specified in item (7) of the "Items to be marked" section, a painted member is made using resins that do not contain formaldehyde and the paint does not emit formaldehyde, it should be marked as "Formaldehyde Free Adhesive and Non-formaldehyde Emitting Paint Used".</p> <p>8. When trademarking to the effect that adhesives containing no formaldehyde have been used is to be indicted as noted under item (8) of the "Items to be marked" section, "Formaldehyde-Free Adhesives Used" shall be indicated.</p> <p>9. The matters specified in (1) of the "Items to be marked" section shall be marked as prescribed in the Appendix, in a conspicuous place of each piece or unit of glulams.</p>
Items prohibited from marking	The same as the section "Items prohibited from marking" in Section 1 of Article 3.

2. The quality standards for laminae set forth in the preceding section shall be as provided hereunder:
- (1) Visually Rated Lamina
- (a) Standards for Lamina Quality

Category	Criteria			
	Grade 1	Grade 2	Grade 3	Grade 4

Strength performance (only for lamina for outer layer of symmetrical mixed-grade composition glulam, for lamina for outer layer of tensile side of non-symmetrical mixed grade composition glulam and for lamina for same-grade composition glulam)		<p>1. Laminae without end joints</p> <p>For a sample lamina taken from one lot according to Section 1 of the Appendix, the results of bending test B specified in (b) of Item (7) of Section 3 of the Appendix shall meet the requirements set forth in (1) and (2) below:</p> <p>(1) The average value of Young's modulus of bending for the sampled laminae shall be not less than the value listed in the "Average value" column in table (b).</p> <p>(2) Not less than 95% of the "Young's modulus of bending" values for the sampled laminae shall be not less than the value listed in the "Minimum value" column of table (b).</p> <p>2. Laminae with end joints</p> <p>For a sampled lamina taken from one lot according to Section 1 of the Appendix, the results of bending test C specified in (c) of Item (7) of Section 3 of the Appendix or the results of the tensile test specified in Item (8) of the same section of the Appendix shall meet either requirements set forth in (1) and (2) below or those set forth in (3) and (4) below:</p> <p>(1) The average value of bending strength for test specimens shall be more than or equal to the value set forth in the "Average value" column of table (b).</p> <p>(2) The bending strengths of not less than 95% of the test specimens shall be more than or equal to the value set forth in the "Minimum value" column of table (b).</p> <p>(3) The average tensile strength value for test specimens shall be more than or equal to the value obtained by multiplying the value in the "Average value" column of table (b), by the coefficient found in the left column of table (c) corresponding to the width category of the test specimen noted in the right column of the same table.</p> <p>(4) The tensile strengths of not less than 95% of the test specimens shall be more than or equal to the value obtained by multiplying the value listed in the "Minimum value" column of table (b), by the coefficient listed in the left column of table (c) corresponding to the width category of the test specimens noted in the right column of the same table.</p>			
Knots and holes	Group knot diameter ratio (CKDR)	Permitted up to 20%.	Permitted up to 30%.	Permitted up to 40%.	Permitted up to 50%.
	Edge Knot diameter ratio	Permitted up to 17%.	Permitted up to 25%.	Permitted up to 33%.	Permitted up to 50%.
Slope of Grain		Permitted up to 1/16.	Permitted up to 1/14.	Permitted up to 1/12.	Permitted up to 1/8.
Decay		Not permitted.	The same as left.	The same as left.	The same as left.
Splits / Checking		Permitted if it is very minimal and not conspicuous.	The same as left.	The same as left.	Permitted if its width is very narrow and its length is not more than 50mm.
Discoloration		Permitted if not conspicuous.	The same as left.	The same as left.	The same as left.
Raised grain		Permitted if not conspicuous.	The same as left.	The same as left.	The same as left.

Mean width of annual rings (limited to Radiata pine)		Permitted up to 6 mm.	The same as left.		
Center core or pith (Radiata pine only)	Less than a width of 19cm	Annual ring shall not be within a 50 mm radius of the center pith.	The same as left.	The same as left.	Permitted if the length of pith in thickness surface is not more than 1/4 of the lamina length.
	Width of 19cm or greater	One third of the width measured from the lamina edge shall not contain annual rings whose curve radius are within 50mm of the pith.	The same as left.	The same as left.	Permitted if the length of pith in thickness surface is not more than 1/4 of the lamina length.
Other defects		Permitted if very slight.	The same as left.	The same as left.	Permitted if slight.

(Note) 1 "The group knot diameter ratio" represents the sum of the knot and/or hole diameters present in any 15 cm section, measured along the length of the lamina, taken as a percentage of the lamina cross-sectional area.

2 "Slope of grain" is the ratio of the variance of the slope of the grain from a stright line parallel to the side of the lamina measured over a given distance.

3 A knot is considered to be an "edge knot" if it lies within 10mm of the edge of the lamina (5mm if the lamina has been dried and planed).

4 Measurement of a center core shall be based on the method shown in the table below and performed by: using a clear plastic plate on which semicircles of known radii from 50 mm to 100 mm at 5 mm intervals are drawn (hereinafter referred to as a "measuring tool"), exactly overlaying the 50 mm radius curve of the measuring tool over the annual rings closest to the pith on the butt end surface and comparing annual ring boundaries within the area between the 50-mm-radius curve and the 100-mm-radius curve of the measuring tool.

(b) Lamina strength performance standard

s p e c i e s	Wood species	Visual grade category lamina					
		Upper: Young's modulus of bending (GPa or 103N/mm ²) Middle: Bending strength (MPa or N/mm ²) Lower: Tensile strength (MPa or N/mm ²)					
		Grade 1		Grade 2		Grade 3	
		Average value	Minimum	Average value	Minimum	Average value	Minimum
A	Apiton (Dipterocarpus spp.)	16.0	13.0	14.0	11.5	12.5	10.5
		63.0	47.5	54.0	40.5	48.5	36.5
		37.5	28.0	32.0	24.0	28.5	21.5
B	Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga)	14.0	11.5	12.5	10.5	11.0	9.5
		54.0	40.5	48.5	36.5	45.0	34.0
		32.0	24.0	28.5	21.5	26.5	20.0
C	Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Port Orford cedar (Chamaecyparis lawsoniana)	12.5	10.5	11.0	9.5	10.0	8.5
		48.5	36.5	45.0	34.0	42.0	31.5
		28.5	21.5	26.5	20.0	24.5	18.5
D	Tsuga (Tsuga sieboldii), Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana), Alaskan yellow cedar (Chamaecyparis nootkatensis), Radiata pine (Pinus radiata), Western hemlock (Tsuga heterophilla)	11.0	9.5	10.0	8.5	9.0	7.5
		45.0	34.0	42.0	31.5	39.0	29.5
		26.5	20.0	24.5	18.5	23.5	17.5
E	Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), True firs (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contota), Benimatsu (Pinus koraiensis), Ponderosa pine (Pinus ponderosa), Scotch pine (Pinus sylvestris), Jack pine (Pinus banksiana), Lauan (Parashorea, Pentacme, Shorea spp.)	10.0	8.5	9.0	7.5	8.0	6.5
		42.0	31.5	39.0	29.5	36.0	27.0
		24.5	18.5	23.5	17.5	21.5	16.0
F	Sugi (Cryptomeria japonica), Western red cedar (Thuja plicata), White cypress pine (Callitris glauca)	9.0	7.5	8.0	6.5	7.0	6.0
		39.0	29.5	36.0	27.0	33.0	25.0
		23.5	17.5	21.5	16.0	20.0	15.0

(c) Coefficient

Length of test piece in the widthwise direction (mm)		Coefficient
	Up to 150	1.00
More than 150	Up to 200	0.95
More than 200	Up to 250	0.90
More than 250		0.85

(2) Laminae Rated by the Grading Machine

(a) Quality Standards for laminae

Category	Criteria								
Strength performance	<p>(MSR lamina)</p> <p>1. “Young’s modulus of bending” values for MSR laminae shall be not less than the corresponding value in the middle column of table (b), corresponding to the respective mechanical grade noted in the left-hand column of the same table.</p> <p>2. Lamina used in the outermost layer or the outer layer of mixed-grade composition glulam (symmetrical) or lamina for the outermost layer or outer layer on the tensile side of mixed-grade composition glulam (non-symmetrical), and lamina taken from one lot of same-grade composition glulam according to Section 1 of the Appendix, the results of bending test C specified in (c) of Item (7) of Section 3 in the Appendix or the results of tensile test specified in Item (8) of the same section in the Appendix shall satisfy the criteria for bending strength or tensile strength listed in the right-hand column corresponding to the lamina machine grade listed in the left-hand column of Table b as described below:</p> <p>(1) The average value of bending strengths for test specimens shall be more than or equal to the value noted in the corresponding column of table (b).</p> <p>(2) The bending strengths of at least 95% of test specimens shall be more than or equal to the minimum value noted in table (b).</p> <p>(3) The average tensile strength value for test specimens shall be more than or equal to the value obtained by multiplying the value listed in the column for average values in Table (b) by the coefficient listed in the right-hand column of Table (C) that corresponds to the lamina width category in the left-hand column of the same table.</p> <p>(4) The tensile strength values of at least 95% of test specimens shall be more than or equal to the minimum tensile strength value obtained by multiplying the value listed in the column for minimum values in Table b by the coefficient listed in the right-hand column of Table (C) that corresponds to the lamina width category in the left-hand column of the same table.</p> <p>3. MSR lamina in this section shall have undergone inspections at regular intervals not only to verify the average value of Young’s modulus satisfies the standard value, but also to verify the bending strength or tensile strength corresponding to the low point Young’s modulus in the length direction is more than or equal to the standard strength or tensile value.</p> <p>(Lamina rated by the grading machine)</p> <p>4. Shall be the same as the provision 1.</p> <p>5. For a lamina for the outermost layer or the outer layer of mixed-grade composition glulam (symmetrical), a lamina for the outermost layer of the tensile side or the outer layer of mixed-grade composition glulam (non-symmetrical), and laminae glued together in the length direction of same-grade composition glulam according to Section 1 of the Appendix shall meet not only the standards set forth in Section 1 of the Appendix but also standards for a sample lamina taken from one lot according to Section 1 of the Appendix, which are set forth in Section 2 of the Appendix.</p>								
Decay	Not permitted.								
Splits / checking	Permitted if it is very minimal and not conspicuous.								
Discoloration	Permitted if not conspicuous.								
Raised grain	Permitted if not conspicuous.								
Quality of both ends of material (MSR grade only)	<p>The equivalent group knot diameter ratio of knots and holes that are present on the lamina ends where measurement by machine is not possible, shall not be larger than the equivalent diameter ratio in the center section of the lamina (where measurement by the grading machine was conducted), or the corresponding end of piece group knot ratio shall satisfy the criteria listed in the right-hand column of the table below.</p> <table border="1" data-bbox="448 1727 1350 1939"> <tbody> <tr> <td data-bbox="448 1727 962 1783">Lamina for outermost layer and outer layer of mixed-grade composition glulam</td> <td data-bbox="962 1727 1350 1783">17%</td> </tr> <tr> <td data-bbox="448 1783 962 1839">Lamina for middle layer of mixed-grade composition glulam</td> <td data-bbox="962 1783 1350 1839">25%</td> </tr> <tr> <td data-bbox="448 1839 962 1895">Lamina for inner layers of mixed-grade composition glulam</td> <td data-bbox="962 1839 1350 1895">33%</td> </tr> <tr> <td data-bbox="448 1895 962 1939">Lamina for same-grade composition glulam</td> <td data-bbox="962 1895 1350 1939">17%</td> </tr> </tbody> </table>	Lamina for outermost layer and outer layer of mixed-grade composition glulam	17%	Lamina for middle layer of mixed-grade composition glulam	25%	Lamina for inner layers of mixed-grade composition glulam	33%	Lamina for same-grade composition glulam	17%
Lamina for outermost layer and outer layer of mixed-grade composition glulam	17%								
Lamina for middle layer of mixed-grade composition glulam	25%								
Lamina for inner layers of mixed-grade composition glulam	33%								
Lamina for same-grade composition glulam	17%								
Other defects	Permitted if very slight.								

(Note) The “equivalent diameter ratio” shall refer to a ratio of the projected area of defects onto a butt-end surface to the total area of the same surface.

(b) Strength performance standards for laminae

Grade by machine rating	Young's modulus of bending (GPa or 10 ³ N/mm ²)	Bending strength (MPa or N/mm ²)		Tensile strength (MPa or N/mm ²)	
		Average value	Minimum value	Average value	Minimum value
L200	20.0	81.0	61.0	48.0	36.0
L180	18.0	72.0	54.0	42.5	32.0
L160	16.0	63.0	47.5	37.5	28.0
L140	14.0	54.0	40.5	32.0	24.0
L125	12.5	48.5	36.5	28.5	21.5
L110	11.0	45.0	34.0	26.5	20.0
L100	10.0	42.0	31.5	24.5	18.5
L 90	9.0	39.0	29.5	23.5	17.5
L 80	8.0	36.0	27.0	21.5	16.0
L 70	7.0	33.0	25.0	20.0	15.0
L 60	6.0	30.0	22.5	18.0	13.5
L 50	5.0	27.0	20.5	16.5	12.0
L 40	4.0	24.0	18.0	14.5	10.5
L 30	3.0	24.0	16.0	12.5	9.5

(c) Coefficient

Lamina width (mm)		Coefficient
	Up to 150	1.00
More than 150	Up to 200	0.95
More than 200	Up to 250	0.90
More than 250		0.85

3. Standard for Lamina lay-up Quality is as follows:

(1) Symmetrical Mixed-grade lay-ups

(a) Outermost Lamina

Outermost lamina Classes 1 through 5 are listed in the table below by the wood species groups specified in Table b Item (1) in the preceding section, correspond to the machine grades for outermost lamina listed in the right-hand column of Appended Table (1) and to the (symmetrical mixed grade lay-ups) strength classes listed in the left-hand column of the same table.

Grade by grading machine	Wood species group					
	A	B	C	D	E	F
L200	Class 1					
L180	Class 2	Class 1				
L160	Class 3	Class 2	Class 1			
L140	Class 4	Class 3	Class 2	Class 1		
L125		Class 4	Class 3	Class 2	Class 1	
L110			Class 4	Class 3	Class 2	Class 1
L100				Class 4	Class 3	Class 2
L 90					Class 4	Class 3
L 80						Class 4
L 70						Class 5
L 60						
L 50						
L 40						
L 30						

(b) Lamina Quality Composition

Standards for the composition of lamina quality shall be as specified in the table below

		Lamina for outermost layer	Lamina for outer layer	Lamina for middle layer	Lamina for inner layer
Lamina for outermost layer, graded as Class 1	Visually rated lamina	Not permitted for use	Not permitted for use	Not permitted for use	Not lower than Grade 3
	Lamina rated by grading machine	G	Not lower than Δ 1G	Not lower than Δ 2G	Not lower than Δ 4G
	Knot diameter ratio at the edge part of width-wise surface	Not more than 17%	Other than MSR lamina, not more than	Other than MSR lamina, not more than	Other than MSR lamina, not more than

Lamina for outermost layer, graded as Class 2	Visually rated lamina	Not permitted for use	Not permitted for use	Not lower than Grade 3	Not lower than Grade 4
	Lamina rated by grading machine	G	Not lower than $\Delta 1G$	Not lower than $\Delta 2G$	Not lower than $\Delta 4G$
	Knot diameter ratio at the edge part of width-wise surface	Not more than 17%	Other than MSR lamina, not more than	Other than MSR lamina, not more than	Other than MSR lamina, not more than
Lamina for outermost layer, graded as Class 3	Visually rated lamina	Not permitted for use	Not lower than Grade 2	Not lower than Grade 3	Not lower than Grade 4
	Lamina rated by grading machine	G	Not lower than $\Delta 1G$	Not lower than $\Delta 2G$	Not lower than $\Delta 4G$
	Knot diameter ratio at the edge part of width-wise surface	Not more than 17%	Other than MSR lamina, not more than	Other than MSR lamina, not more than	Other than MSR lamina, not more than
Lamina for outermost layer, graded as Class 4	Visually rated lamina	Not permitted for use	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4
	Lamina rated by grading machine	G	Not lower than $\Delta 1G$	Not lower than $\Delta 2G$	Not lower than $\Delta 4G$
	Knot diameter ratio at the edge part of width-wise surface	Not more than 25%	Other than MSR lamina, not more than	Other than MSR lamina, not more than	Other than MSR lamina, not more than
Lamina for outermost layer, graded as Class 5	Visually rated lamina	Not permitted for use	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4
	Lamina rated by grading machine	G	Not lower than $\Delta 1G$	Not lower than $\Delta 2G$	Not lower than $\Delta 4G$
	Knot diameter ratio at the edge part of width-wise surface	Not more than 25%	Other than MSR lamina, not more than	Other than MSR lamina, not more than	Other than MSR lamina, not more than

(Note)1. G is the machine grade of the outermost lamina specified in table (a).

2. $\Delta 1G$, $\Delta 2G$, $\Delta 3G$ and $\Delta 4G$ machine grades listed in the table (a) that is one class, two classes, three classes, and four classes lower than G, respectively.

3. If only machine graded lamina are used, and lamina having a machine grade one grade higher than Class 1 of the respective wood species group listed in table (a) is used along with outermost lamina Class 1 criteria, structural glued laminated timbers can be manufactured to the next highest strength grade.

4. If only MSR lamina are used, the wood species groups listed in table (a) may be disregarded, and the glulam may be manufactured to any strength category the corresponding lamina grades will support provided outermost lamina Class 1 criteria are followed. However, in this case, with regard to adhesive performance, qualification testing shall be performed to verify the appropriate use environment criteria are satisfied.

5. If the strength grade of a structural glued laminated timber has been verified by simulation calculations associated with full scale strength test or by validation testing for the glulam, said structural glulam may be deemed to have complied with the standards in this section.

(2) Mixed-grade Composition Glulam (Symmetrical)

(a) MSR Laminae

As shown in the table below, laminae for the outermost layer shall be graded from L 200 through to L 30 depending on the machine grade of outermost layer laminae noted in the right column of Appended Table (2) that corresponds to the strength grade specified in the left column of the same table (corresponding to the strength grade of the glulam to be graded).

Grade by grading machine
L200
L180
L160
L140
L125
L110
L100
L 90
L 80
L 70
L 60
L 50
L 40
L 30

(b) Lamina Quality Composition

Criteria for lamina quality composition shall be as specified in the table below:

Marking grade	Lamina for outermost layer	Lamina for outer layer	Lamina for middle layer	Lamina for inner layer
ME120-F330	Not lower than L160	Not lower than L160	Not lower than L110	Not lower than L30
ME105-F300	Not lower than L140	Not lower than L140	Not lower than L100	Not lower than L30
ME 95-F270	Not lower than L125	Not lower than L125	Not lower than L90	Not lower than L30
ME 85-F255	Not lower than L110	Not lower than L110	Not lower than L80	Not lower than L30

(Note) 1. If the strength grade of a structural glued laminated timber has been checked by simulation calculations associated with full scale strength testing or validation testing, said structural glulam may be deemed to have complied with the standards in this section.

2. Bond performance shall be checked, through validation testing, to verify bond performance is suitable for the relevant use environment.

(3) Mixed-grade Composition Glulam (non-symmetrical)

(a) Lamina for Outermost Layer – Tension Side

Outermost lamina classes 1 through 5 are listed in the table below by wood species groups and corresponding to the outermost tension side lamina grades which are also listed in the right-hand column of "special Table Attachment 1" with the rated strength classes for non-symmetrical mixed grade members listed in the center column of the same table.

		Compression side				Tension side			
		Lamina for outermost layer	Lamina for outer layer	Lamina for middle layer	Lamina for inner layer	Lamina for inner layer	Lamina for middle layer	Lamina for outer layer	Lamina for outermost layer
Lamina for the outermost layer of tension side, graded as Class 1	Visually rated lamina	Not lower than Grade 2	Not lower than Grade 2	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 3	Not permitted for use	Not permitted for use	Not permitted for use
	Lamina rated by grading machine	Not lower than Δ2G	Not lower than Δ2G	Not lower than Δ3G	Not lower than Δ4G	Not lower than Δ4G	Not lower than Δ2G	Not lower than Δ1G	G
	Knot diameter ratio at an edge of width surface	Other than MSR lamina, not more than 25%	Other than MSR lamina, not more than 25%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 25%	Other than MSR lamina, not more than 17%	Not more than 17%
Lamina for the outermost layer of tension side, graded as Class 2	Visually rated lamina	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 3	Not permitted for use	Not permitted for use
	Lamina rated by grading machine	Not lower than Δ2G	Not lower than Δ2G	Not lower than Δ3G	Not lower than Δ4G	Not lower than Δ4G	Not lower than Δ2G	Not lower than Δ1G	G
	Knot diameter ratio at an edge of width surface	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 25%	Not more than 17%
Lamina for the outermost layer of tension side,	Visually rated lamina	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 3	Not lower than Grade 2	Not permitted for use
	Lamina rated by grading machine	Not lower than Δ2G	Not lower than Δ2G	Not lower than Δ3G	Not lower than Δ4G	Not lower than Δ4G	Not lower than Δ2G	Not lower than Δ1G	G

graded as Class 3	Knot diameter ratio at an edge of width surface	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 25%	Not more than 17%
Lamina for the outermost layer of tension side, graded as Class 4	Visually rated lamina	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 3	Not lower than Grade 3	Not permitted for use
	Lamina rated by grading machine	Not lower than $\Delta 2G$	Not lower than $\Delta 2G$	Not lower than $\Delta 3G$	Not lower than $\Delta 4G$	Not lower than $\Delta 4G$	Not lower than $\Delta 2G$	Not lower than $\Delta 1G$	G
graded as Class 5	Knot diameter ratio at an edge of width surface	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Not more than 25%
Lamina for the outermost layer of tension side, graded as Class 5	Visually rated lamina	Not lower than Grade 3	Not lower than Grade 3	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 4	Not lower than Grade 3	Not lower than Grade 3	Not permitted for use
	Lamina rated by grading machine	Not lower than $\Delta 2G$	Not lower than $\Delta 2G$	Not lower than $\Delta 3G$	Not lower than $\Delta 4G$	Not lower than $\Delta 4G$	Not lower than $\Delta 2G$	Not lower than $\Delta 1G$	G
graded as Class 5	Knot diameter ratio at an edge of width surface	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 50%	Other than MSR lamina, not more than 33%	Other than MSR lamina, not more than 33%	Not more than 25%

(Note) 1. G shall represent the lamina machine grade listed in table (a) outermost layer laminae, tension side.

2. $\Delta 1G$, $\Delta 2G$, $\Delta 3G$, and $\Delta 4G$ shall be the lamina machine grade listed in table (a) that is one class, two, three classes and four classes lower than G, respectively.

3. If only machine graded lamina are used, and lamina having a machine grade one grade higher than Class 1 of the respective wood species group listed in table (a) is used along with outermost lamina Class 1 criteria, structural glued laminated timbers can be manufactured to the next highest strength grade.

4. If only MSR lamina are used, the wood species groups listed in table (a) may be disregarded, and the glulam may be manufactured to any strength category the corresponding lamina grades will support provided outermost lamina Class 1 criteria are followed. However, in this case, with regard to adhesive performance, qualification testing shall be performed to verify the appropriate use environment criteria are satisfied.

5. If the strength grade of a structural glued laminated timber has been verified by simulation calculations

associated with full scale strength test or by validation testing for the glulam, said structural glulam may

(4) Same-grade Composition Glued Laminated Timber

(a) Lamina

a. Visually Graded Laminae

Lamina shall be classified by Class 1 through Class 3 according to the table below for lamina corresponding to the visual grades and wood species groups listed in the Special Attachment Table 3 corresponding to the member strength Grade in the same Table.

Grade by visual rating	Wood species group					
	A	B	C	D	E	F
Grade 1	Class 1	Class 1	Class 1	Class 1	Class 1	Class 1
Grade 2	Class 2	Class 2	Class 2	Class 2	Class 2	Class 2
Grade 3	Class 3	Class 3	Class 3	Class 3	Class 3	Class 3

b. Laminae rated by Grading Machine

Lamina shall be classified by Class 1 through Class 4 according to the table below for lamina corresponding to the machine grade and wood species groups listed in the Special Attachment Table 3 corresponding to the member strength Grade in the same Table.

Grade by the grading machine	Wood species group					
	A	B	C	D	E	F
L200	Class 1					
L180	Class 1	Class 1				
L160	Class 1	Class 1	Class 1			
L140	Class 2	Class 1	Class 1	Class 1		
L125	Class 3	Class 2	Class 1	Class 1	Class 1	
L110		Class 3	Class 2	Class 1	Class 1	Class 1
L100			Class 3	Class 2	Class 1	Class 1
L 90				Class 3	Class 2	Class 1
L 80					Class 3	Class 2
L 70						Class 3
L 60						Class 4

b. Lamina Composition Quality

Standards for the lamina composition quality shall be as specified in the table below:

	lamina	
In the case of Class 1 lamina	Visually graded	Not lower than Grade 1
	Lamina rated by grading machine	G
	Knot diameter ratio at an edge of width	Other than MSR lamina, not more than 17%
In the case of Class 2 lamina	Visually graded	Not lower than Grade 2
	Lamina rated by grading machine	G
	Knot diameter ratio at an edge of width	Other than MSR lamina, not more than 25%
In the case of Class 3 lamina	Visually graded	Not lower than Grade 3
	Lamina rated by grading machine	G
	Knot diameter ratio at an edge of width	Other than MSR lamina, not more than 33%
In the case of Class 4 lamina	Visually graded	Not permitted for use
	Lamina rated by grading machine	G
	Knot diameter ratio at an edge of width	Other than MSR lamina, not more than 33%

(Note) G shall refer to the machine grade specified in table b of Section a "Lamina."

4. Standards for surface quality of finished glulam specified in Section 1 shall be as follows:

Categories	Criteria		
	Type 1	Type 2	Type 3
Paint condition	Well worked.	The same as left.	The same as left.
Knots (except live knot), holes, resin pocket, resin streak, bark pocket, splits, rough grain, flaw, scratch and open joint	Not permitted or permitted if excellent workmanship can be achieved by plugging, or filling of synthetic resin, etc.	Permitted if not conspicuous and not injurious to workability.	
Discoloration and stains	Permitted if they harmonize with the color and gross specific to the timber and its appearance is balanced.	Permitted if not conspicuous.	The same as left.
Knife skip, adhesive bleeding or wane	Not permitted.	The same as left.	1. Permitted if any knife skip and adhesive bleeding is local and inconspicuous. 2. For wane, it shall be permitted if the dimensions are extremely small and the degree is

5. The standards for the minimum radius of curvature of the curved part set forth in Section 1 shall be as provided hereunder:

The minimum radius of curvature of the curved part (refers to the radius of curvature at the most inward curved point of a lamina where the curvature radius is minimum) shall be not less than the corresponding value listed in the table below.

Thickness of the thickest lamina	Minimum radius of curvature of the curved part			
	A case where wood species of a lamina is only applicable to No. 5 or 6 of the "Wood Species Group" specified in the table of the "Criteria" column of the "Bonding		Other cases than the left	
	In the case of partially curved	Other cases than the left	In the case of partially curved	Other cases than the left
5	500	525	600	625
10	1,080	1,300	1,280	1,540
15	1,770	2,280	2,070	2,670
20	2,480	3,400	3,000	4,000
25	3,500	4,750	4,125	5,625
30	4,650	6,300	5,490	7,440
35	5,950	8,050	7,140	9,450
40	7,480	9,920	9,000	11,600
45	9,360	11,925	11,115	13,950
50	11,750	14,000	13,500	16,500

(Note) In the case of partially curved timbers, "partial curve" means one section of the member is curved in the lengthwise direction while the remaining sections are straight.

6. Standards for end joint spacing in adjacent layers as specified in Section 1, shall be as follows.

	Those using scarf joints (meaning those for which the scarf inclination is not more than 1/7.5)	Those using scarf joints (meaning those for which the scarf inclination is not more than 1/7.5, those for which fitness is 0.1mm or more, those for which the finger length is 10.5 mm or more (for inner layer) or 12.0 mm or more (for layers other than inner layer)
A case where, apparently, the lamina is used only for beams or other locations where high bending strengths are required	For lamina in the outermost layer, as well as outer layer lamina (limited to the lamina for outermost layer and lamina for outer layer of the tensile side of a mixed-grade composition glulam (non-symmetrical) and their adjacent lamina, end jointed portions among these laminae shall	For a lamina for outermost layer and a lamina for outer layer (limited to the lamina for outermost layer and lamina for outer layer of the tensile side, for a mixed-grade composition glulam (non-symmetrical) and their adjacent lamina, end jointed portions among these laminae shall be not less than 15 cm away from one another.
A case where, apparently, the lamina is used only for posts or other locations where high compressive strengths are required	Joints of lamina of the adjacent lamina shall not be overlapped.	The same as left.
Other cases than those above	Joints of lamina of the adjacent lamina shall not be overlapped.	For the adjacent laminae, end jointed portions shall be spaced at least 15 cm away from one another.

(Note) If the sufficient strength of lamina end joints have been checked by a proof loader, such structural glulam may be deemed to have complied with the standards in this section.

Appended Table

(1) Mixed-grade composition glulam (symmetrical and non-symmetrical)

Mixed-grade composition glulam (symmetrical) strength grade	Mixed-grade composition glulam (non-symmetrical) strength grade	Machine grade of outermost lamina
E170-F495	E160-F480	L200
E150-F375	E140-F420	L180
E135-F375	E125-F360	L160
E120-F330	E110-F315	L140
E105-F300	E100-F285	L125
E 95-F270	E 90-F255	L110

E 85–F255	E 80–F240	L100
E 75–F240	E 70–F225	L 90
E 65–F225	E 60–F210	L 80
E 65–F220	E 60–F205	L 80
E 55–F200	E 50–F170	L 70

(Note) 1. With regard to lamina composition quality for E65–F225 members, use of L50 lamina is restricted to the inner layer.

2. With regard to lamina composition quality for E60–F210 members, L50 is restricted for use in the inner layers of the compression side and the tensile side.

(2) Mixed-grade composition glulam (specified symmetrical composition)

Specified mixed-grade composition glulam strength grade	Grade of outermost layer lamina specified as machine rating grade
ME120–F330	Not lower than L160
ME105–F300	Not lower than L140
ME 95–F270	Not lower than L125
ME 85–F255	Not lower than L110

(3) Same-grade composition glulam

Strength grade of four (4) or more layers of same-grade composition glulam	Strength grade of three (3) layers of same-grade composition glulam	Strength grade of two (2) layers of same-grade composition glulam	Grade of lamina						Grade by machine rating
			Grade by visual rating						
			Wood species group A	Wood species group B	Wood species group C	Wood species group D	Wood species group E	Wood species group F	
E190–F615	E190–F555	E190–F510							L200
E170–F540	E170–F495	E170–F450							L180
E150–F465	E150–F435	E150–F390	Grade						L160
E135–F405	E135–F375	E135–F345	Grade						L140
E120–F375	E120–F330	E120–F300	Grade						L125
E105–F345	E105–F300	E105–F285	Grade						L110
E 95–F315	E 95–F285	E 95–F270	Grade		Grade			Grade	L100
E 85–F300	E 85–F270	E 85–F255			Grade		Grade	Grade	L 90
E 75–F270	E 75–F255	E 75–F240					Grade	Grade	L 80
E 65–F255	E 65–F240	E 65–F225						Grade	L 70
E 55–F225	E 55–F225	E 55–F200							L 60

(Standards for Decorative Structural Glued Laminated Timber Post)

Article 6. The standards for decorative structural glued laminated timber posts shall be as provided hereunder:

Category	Criteria																		
Product quality	<p>Bonding quality</p> <p>1. For the bonding quality of a decorative veneer, the results of immersion delamination tests specified in Item (1) of Section 3 of Appendix shall indicate that the delamination rate for both butt ends' surface is 10% or lower and the sum of the length of delamination that occurs in the same glue line is not more than one third of the length of each test specimen.</p> <p>2. The bonding quality of laminated layers of a lamina (excluding decorative veneer) shall meet the requirements specified in the following Items of (1), (2), and (4) or Items of (3) and (4):</p> <p>(1) Results of immersion delamination tests specified in Item (1) of Section 3 of Appendix shall indicate that the delamination rate for both butt ends' surface is 5% or lower and the length of delamination that occurs in the same glue line is not more than one fourth of the length of each test specimen.</p> <p>(2) Results of boiling water delamination tests specified in Item (2) of Section 3 of Appendix shall indicate that the delamination rate for both butt ends' surface is 5% or lower, and the length of delamination that occurs in the same glue line is not more than one-fourth of the length of each test specimen.</p> <p>(3) Results of vacuum-pressure delamination tests specified in Item (3) of Section 3 of Appendix shall indicate that the delamination rate for both butt ends' surface is 5% or lower, and the length of delamination that occurs in the same glue line is not more than one-fourth of the length of each test specimen.</p> <p>(4) Results of block shear tests specified in Item (4) of Section 3 of Appendix shall indicate that both the shear strength and the wood failure rate of a test specimen are not less than the values listed in the table below. However, in a case where one of both the shear strength and the wood failure rate of a test specimen is not less than the values listed in the table below, and the other is less than such values, retests for the glue line area may be performed.</p> <table border="1" data-bbox="459 1064 1364 1886"> <thead> <tr> <th>Wood species group</th> <th>Shear strength (MPa or N/mm²)</th> <th>Wood failure ratio (%)</th> </tr> </thead> <tbody> <tr> <td>Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Apiton (Dipterocarpus spp.)</td> <td>9.6</td> <td rowspan="2">60</td> </tr> <tr> <td>Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana)</td> <td>8.4</td> </tr> <tr> <td>Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga), White cypress pine (Callitris glauca)</td> <td>7.2</td> <td rowspan="3">65</td> </tr> <tr> <td>Tsuga (Tsuga sieboldii), Alaska yellow cedar (Chamaecyparis nootkatensis), Benimatsu (Pinus koraiensis), Radiata pine (Pinus radiata), Beitsuga (Tsuga heterophilla)</td> <td>6.6</td> </tr> <tr> <td>Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), Beimomi (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contota), Ponderosa pine (Pinus ponderosa), Pushuu akamatsu (Pinus sylvestris)</td> <td>6.0</td> </tr> <tr> <td>Sugi (Cryptomeria japonica), Beisugi (Thuja plicata)</td> <td>5.4</td> <td>70</td> </tr> </tbody> </table>	Wood species group	Shear strength (MPa or N/mm ²)	Wood failure ratio (%)	Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Apiton (Dipterocarpus spp.)	9.6	60	Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana)	8.4	Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga), White cypress pine (Callitris glauca)	7.2	65	Tsuga (Tsuga sieboldii), Alaska yellow cedar (Chamaecyparis nootkatensis), Benimatsu (Pinus koraiensis), Radiata pine (Pinus radiata), Beitsuga (Tsuga heterophilla)	6.6	Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), Beimomi (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contota), Ponderosa pine (Pinus ponderosa), Pushuu akamatsu (Pinus sylvestris)	6.0	Sugi (Cryptomeria japonica), Beisugi (Thuja plicata)	5.4	70
	Wood species group	Shear strength (MPa or N/mm ²)	Wood failure ratio (%)																
	Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Apiton (Dipterocarpus spp.)	9.6	60																
	Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana)	8.4																	
	Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga), White cypress pine (Callitris glauca)	7.2	65																
	Tsuga (Tsuga sieboldii), Alaska yellow cedar (Chamaecyparis nootkatensis), Benimatsu (Pinus koraiensis), Radiata pine (Pinus radiata), Beitsuga (Tsuga heterophilla)	6.6																	
	Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), Beimomi (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contota), Ponderosa pine (Pinus ponderosa), Pushuu akamatsu (Pinus sylvestris)	6.0																	
	Sugi (Cryptomeria japonica), Beisugi (Thuja plicata)	5.4	70																
Moisture content	The results of moisture content tests specified in Item (5) of Section 3 of Appendix shall indicate that an average of the moisture content of test specimens taken from the same sample glulam is 15% or lower.																		
Resistance to surface check	The results of tests for "Resistance to Surface Check" specified in Item (6) of Section 3 of Appendix shall indicate that no cracks develop on the surface of the test specimen or that if a crack develops, it is only a slight crack.																		
Lamina quality	Shall meet the "Standards for Lamina Quality" set forth in Section 3.																		

Bending property	For decorative structural glued laminated timber posts, the results of the “bending test A” specified in (d) of Item (7) of Section 3 of the Appendix shall indicate that both Young’ s modulus of bending and the bending strength of the sample glulam are not less than the value set forth in the table below:	
	Wood species group	Young’ s modulus of bending (GPa or 10^3N/mm^2)
	Apiton (Dipterocarpus spp.)	13.0
	Itayakaede (Acer mono), Birch (Betula maximowicziana), Beech (Fagus crenata), White oak (Quercus crispula), Keyaki (Zelkova serrata), Dafurika karamatsu (Larix gmelini), Southern pine (Pinus spp.), Beimatsu (Pseudotsuga)	11.5
	Hinoki (Chamaecyparis obtusa), Hiba (Thujopsis dolabrata), Karamatsu (Larix leptolepis), Akamatsu (Pinus densiflora), Kuromatsu (Pinus Thunbergii), Beihi (Chamaecyparis lawsoniana)	10.5
	Tsuga (Tsuga sieboldii), Tamo (Fraxinus mandshrica), Shioji (Fraxinus apaethiana), Nire (Ulmus davidiana), Alaska yellow cedar (Chamaecyparis nootkatensis), Radiata pine (Pinus radiata), Beitsuga (Tsuga heterophilla)	9.5
	Momi (Abies Firma), Todomatsu (Abies sachalinensis), Ezomatsu (Picea jezoensis), Beimomi (Abies spp.), Spruce (Picea spp.), Lodgepole pine (Pinus contota), Benimatsu (Pinus koraiensis), Ponderosa pine (Pinus ponderosa), Pushuu akamatsu (Pinus sylvestris), Jack pine (Pinus Pinus banksiana) Lauan (Parashorea, Pentacme, Shorea spp.)	8.5
	Sugi (Cryptomeria japonica), Beisugi (Thuja plicata), White cypress pine (Callitris glauca)	7.5
Formaldehyde emission amount	The same as the formaldehyde emission amount specified in paragraph 1 of Article 3.	
Quality of visible surface	Shall meet the “The quality standards for visible surfaces” set forth in Section 4.	
Warping, bows and twisting	The deviated length shall be not less than 1 mm per 3 meters of length of a glulam.	
Grooving, chamfering and cutting works	Well worked.	
Thickness of decorative veneer	Shall be not less than 1.2 mm.	
Materials	Lamina	1. The number of lamina layers (excluding decorative veneer) shall be 5 layers or more. 2. A lamina (excluding decorative veneer) shall have a uniform thickness. However, this shall not apply to a case where the laminae are arranged in such a manner that the composition of the thickness is symmetric around the central axis of the lamina and this thickness is more than or equals to two-thirds of the thickness of the thickest lamina in the composition layer.
	Adhesive	1. Adhesives used for adhesion in the lamination direction of a lamina (excluding decorative veneer) shall be resorcinol resins, resorcinol phenol resins, and water based polymer-isocyanate resins (shall be those that satisfy the performance of “Class 1, No.1” set forth in JIS K 6806. The same shall apply hereunder.), all of which satisfy required performance for “Usage Environment C,” or other adhesives that have a performance equivalent to or higher than that of these resins. 2. Adhesives used for adhesion in the longitudinal direction of a lamina (excluding decorative veneer) shall be resorcinol resins, resorcinol phenol resins, water based polymer-isocyanate resins, melamine resins and melamine-urea copoly-condensation resins, all of which satisfy required performance for “Usage Environment C,” or other adhesives that have a performance equivalent to or higher than that of these resins.
Dimensions	A difference between the marked and the measured dimensions shall be not less than values listed in the table below.	

(Unit: mm)

	Categories	Difference between the marked and measured	
	Short side and long side	+1.5	-0.5
	Length	+5.0	-0

Items to be marked	The same as the section "Items to be marked" in Section 1 of Article 4.
Marking method	Shall be the same as the section "Items to be marked" in Section 1 of Article 4. However, marking of product's name and the name of wood species (core material) shall be made by the method set forth below. (1) Product name The product shall be marked as "decorative structural glued laminated timber post." (2) Name of wood species (core material) The name of wood species shall be given by the most common name.
Items prohibited from marking	The same as the section "Items prohibited from marking" in Section 1 of Article 3.

2. For a decorative structural glued laminated timber post of which laminae are laminated widthwise as adjacent layers, a distance between two of the adhesion locations shall be the same as or not less than twice the thickness of the lamina.

3. The standards for the "Lamina Quality" set forth in Section 1 shall be as provided hereunder:

Category	Criteria
Knots and	Grouped knots diameter ratio shall be not more than 1/4.
Resin pocket, resin streak, and bark	Permitted if slight.
Grain inclination	Permitted up to 1/14.
Decay	Not permitted.
Splits	Permitted if very slight.
Discoloration	Permitted if slight.
Rough grain	Permitted if slight.
Open joints	Not permitted.
Mean width of annual rings (except Radiata pine)	Permitted up to 6 mm.
Center core or pith (only for Radiata pine)	Permitted if annual rings within 50 mm of radius from the center of pith do not exist.
Center core (only for lamina of outermost layer)	Not permitted.
Repair	Permitted if color or grain is fitting to its peripheral timber, and if a repaired part has no gaps and there is no concern of dropping off or denting.
Other defects	Permitted if very slight.

(Note)

1. "Concentrated knot diameter ratio (CKDR)" represents the sum of the percentage of the diameter of a knot and/or hole present on the 15 cm surface of a lamina to the width of the lamina.

2. "Grain inclination" represents a ratio of the slope of the grain direction versus the width direction of a lamina.

3. The term "repair" shall refer to plugging, or filling of synthetic resin, etc.

4. Tiny clearance between the edge parts of scarf joint or finger joint shall not be deemed as a defect.

5. Measurement of a center core shall be based on the method shown in the figure of (Note) set forth in (1)-(a) of Section 2 of Article 5 and performed by using a measuring tool, exactly overlaying the 50 mm radius curve of the measuring tool over the annual ring boundary closest to the pith on the butt end surface, and comparing annual ring boundaries within an area between the 50-mm-radius- and the 100-mm-radius curves of the measuring tool, with such curves.

4. The quality standards for visible surfaces set forth in Section 1. shall be as provided hereunder:

Categories	Criteria
Knots	Not permitted.
Resin pocket, resin streak, and bark	Permitted if very slight.
Chips and flaws	Not permitted.

Decay	Not permitted.
Splits	Not permitted.
Discoloration and stains	Permitted if very slight.
Holes	Not permitted.
Rough grain	Not permitted.
Blister, wrinkle, overlap and open joint	Not permitted.
Inconformity of color and grain	Permitted if the colors and the grain directions of the visible surface roughly harmonize with one another.
Repair	Permitted if the repaired part is small, the color or grain well matches with the surrounding surface, and the repaired part has no clearance and is free of coming-off or indentation.
Other defects	Permitted if very slight.

(Note) Same as the Note for the quality standards for visible surfaces of Article 3 “Standards for glued laminated timber for fixtures.”

Appendix

1 Sampling of Test Samples

(1) For a glulam from which test specimens are to be cut that are intended for immersion delamination tests, boiling water delamination tests, vacuum-pressure delamination tests, block shear tests, moisture content tests, tests for resistance to the surface check, and bending test A (excluding the case of full scale tests (shall refer to a test performed using whole glulam; he same shall apply hereunder) and the case of using a model specimen (shall refer to a scaled-down glulam having the same quality construction of lamina as that of glulam to be graded; the same shall apply hereunder.) or a glulam intended for bending test A on “full scale test” base and for bending tests on decorative structural glued laminated timber posts (hereinafter referred to as a “sample glulam”), the number of sample glulam pieces specified in the following tables (a) or (b) shall be sampled from one production lot at random as a Glued laminated timber for fixtures, decorative glued laminated timber for fixtures, and decorative structural glued laminated timber post (excluding boiling water delamination tests, vacuum-pressure delamination tests, block shear tests, and bending tests)

Size of production lot (in pieces)	Number of sample glued laminated timber (in pieces)	
Up to 200	2 samples	If a retest is required, twice the number of sample glulam pieces specified on the left shall be taken out.
201~500	3 samples	
501~1000	4 samples	
1001~3000	5 samples	
3001 or more	6 samples	

b Structural glued laminated timbers and decorative structural glued laminated timber posts (only limited to boiling water delamination tests, vacuum-pressure delamination tests, block shear tests, and bending tests)

Size of production lot (in pieces)	Number of sample glued laminated timber (in pieces)	
Up to 10	3 samples	If a retest is required, twice the number of sample glulam pieces specified on the left shall be taken out.
11~20	4 samples	
21~100	5 samples	
101~500	6 samples	
501 or more	7 samples	

(2) For a model specimen intended for bending test A in which model specimens are used, the number of model specimens specified in the right column of the following table shall be prepared depending on glulam pieces specified in the left column of the same table.

Size of production lot (in pieces)	Number of pieces of model testing glulam
Up to 10	3 samples
11~20	4 samples
21~100	5 samples
101~500	6 samples
501 or more	7 samples

(3) For laminae intended for bending test B, bending test C, and tensile tests (hereinafter referred to as a “sample lamina”), the number of sample lamina pieces specified in the following table shall be taken out of one lot at random depending on the pieces specified in the left column of the same table.

Size of production lot (in pieces)	Number of sample lamina (in pieces)
Up to 90	5
91~280	8
281~500	13
501~1,200	20
1,200 or more	32

(4) For sample glulams intended for formaldehyde emissions testing, the number of sample glulam pieces specified in the right column of the following table shall be sampled from one lot at random depending on glulam pieces specified in the left column of the same table.

Size of production lot (in pieces)	Number of sample glued laminated timber (in pieces)
Up to 1,000	2
1,001~2,000	3
2,001~3,000	4
3,001 or more	5

2 Determination of Test Results

In a test other than bending test A, bending test B, bending test C, tensile tests, and formaldehyde emission tests, among test specimens cut out of a sample glulam extracted from one lot (in moisture content tests and/or in bending tests for a decorative structural glued laminated timber post, among sample glulams extracted from one lot), the lot of glulams shall be deemed to have passed such test if at least 90% of such test specimens are in compliance with standards related to the test; however, the lot shall be deemed to have failed to pass such test if less than 70% of test specimens are in compliance with the standards.

In a case where 70% or more but less than 90% of the specimens are in compliance with the standards, a retest for the lot shall be performed using sample glulams newly taken from the same lot. According to the retest results, the lot shall be deemed to have passed such test if at least 90% of such sample glulams are in compliance with the standards; the lot shall be deemed to have failed if less than 90% of the sample glulams are in compliance with the given test standards.

3 Testing Method

(1) Immersion Delamination Tests

a Preparation of Test Specimens

(i) Glued laminated timber for fixtures, decorative glued laminated timber for fixtures, and decorative structural glued laminated timber post

Three test specimens, any of which shall have a length of 75 mm and also have the same dimension as that of the butt-end cross-section of each sample glulam, shall be prepared from each full-sized piece of the sample glulam. In addition, for a test specimen from the secondary adhesion portion of a glued laminated timber for fixtures, such specimen shall be prepared so that the adhesion portion can be positioned in center of the specimen and also shall have a length of 180 mm and have the same dimension as that of the butt-end cross-section of each sample glulam. If the length of a finger is not more than 16 mm, by cutting the finger tips, one test specimen shall be prepared of which glue line is exposed on the butt-end cross-section of a sample glulam. If the length of a finger exceeds 16 mm, two test specimens shall be prepared by cutting the center part of the finger of a sample glulam.

(ii) Structural glued laminated timber (structural glulam)

One test specimen shall be prepared from both ends of each sample glulam piece with a length of 75 mm and the same cross section dimension as that of the sample glulam. In addition, for a test specimen of structural glulam of which lamination side is not less than 250 mm in length and of which lamina has a width direction side of 125 mm or more, such test specimen may be split at the member depth mid-point, parallel to the glue line(s). When split as described, the depth in the direction of lamination of each test specimen shall be roughly the same.

b Testing Method

(i) Glued laminated timber for fixtures, decorative glued laminated timber for fixtures, and decorative structural glued laminated timber post

Test specimens, after immersed in water at room temperature (10° C–25° C) for six hours, shall continue to be dried in a thermostatically controlled dryer at 40 ± 3° C (or 70° C ± 3° C for a decorative structural glued laminated timber post (excluding decorative veneer)) so as not to allow moisture to remain inside the dryer, until the dried mass has fallen to a range between 100% and 110% of the pretest mass.

After that, the length of delamination (occurred in glue lines) on both butt ends of test specimen (excluding a test specimen of which delamination gap is less than 0.05 mm and/or of which delamination length is less than 3 mm; the same shall apply hereunder.) shall be measured to calculate not only the delamination rate for both butt ends' surface (The "both butt ends' surface" shall be read as a "finger joint portion on a butt end surface" for a test specimen from secondary adhesion portion of a glued laminated timber for fixtures.) but also the sum of the length of delamination, which occurs in the same glue lines (excluding the glue line of edge joints (except for a glulam glued and laminated during its manufacture of such products as stairs boards); the same shall apply hereunder.), on both butt ends.

(Note)

1 The delamination rate shall be calculated by the following equation:

$$\text{Delamination rate (\%)} = \frac{\text{Sum of the length of delamination on both butt ends}}{\text{Sum of the length of glue lines on both butt ends}} \times 100$$

2 In measurement of delamination length, neither timber fracture caused by, for example, dried splits and knots, nor delaminated portion where a knot is present shall be considered as delamination.

(ii) Structural glued laminated timber (structural glulam)

Test specimens, after being immersed in water at room temperature (10° C–25° C) for 24 hours, shall continue to be dried in a thermostatically controlled dryer at 70° C ± 3° C so as not to allow moisture to remain inside the dryer until the dried mass has fallen to a range between 100% and 110% of the pretest mass. However, for a structural glulam with the “Use Environment A” indication, the above-mentioned treatment shall be conducted twice.

After that, the length of delamination on both butt ends of test specimen shall be measured to calculate not only the delamination rate for both butt end surfaces but also the sum of the length of delamination, which occurs in the same glue lines (excluding the glue line of edge joints; the same shall apply hereunder.), on both butt ends.

(Note)

1 The delamination rate shall be calculated by the following equation:

$$\text{Delamination rate (\%)} = \frac{\text{Sum of the length of delamination on both butt ends}}{\text{Sum of the length of glue lines on both butt ends}} \times 100$$

2 In measurement of delamination length, neither timber fracture caused by, for example, dried splits and knots, nor delaminated portions where a knot is present shall be considered as delamination.

(2) Boiling Water Delamination Tests

a Preparation of Test Specimens

This provision shall be the same as that set forth in Item a of Paragraph (1).

b Testing Method

Test specimens, after being immersed in boiling water for four hours and later after being immersed in water at room temperature (10° C–25° C) for one hour, shall continue to be dried in a thermostatically controlled dryer at 70° C ± 3° C so as not to allow moisture to remain inside the dryer until the dried mass has fallen to a range between 100% and 110% of the pretest mass. However, for a glulam with the “Use Environment A” indication, the above-mentioned treatment shall be conducted twice.

After that, the length of delamination on both butt ends of test specimen shall be measured to calculate not only the delamination rate for both butt ends’ surface but also the sum of the length of delamination, which occurs in the same glue lines, on both butt ends.

(Note)

1 The delamination rate shall be calculated by the following equation:

$$\text{Delamination rate (\%)} = \frac{\text{Sum of the length of delamination on both butt ends}}{\text{Sum of the length of glue lines on both butt ends}} \times 100$$

2 In measurement of delamination length, neither timber fracture caused by, for example, dried splits and knots, nor peeled-off portions where a knot is present shall be considered as delamination.

(3) Vacuum-pressure Delamination Tests

a Preparation of Test Specimens

This provision shall be the same as that set forth in Item a of Paragraph (1).

b Testing Method

Test specimens, after being immersed in boiling water for four hours and later after being immersed in water at room temperature (10° C–25° C) for one hour, shall continue to be dried in a thermostatically controlled dryer at 70° C ± 3° C so as not to allow moisture to remain inside the dryer until the dried mass has fallen to a range between 100% and 110% of the pretest mass. However, for a glulam with the “Use Environment A” indication, the above-mentioned treatment shall be conducted twice.

After that, the length of delamination on both butt ends of test specimen shall be measured to calculate not only the delamination rate for both butt ends’ surface but also the sum of the length of delamination, which occurs in the same glue lines, on both butt ends.

(Note)

1 The delamination rate shall be calculated by the following equation:

$$\text{Delamination rate (\%)} = \frac{\text{Sum of the length of delamination on both butt ends}}{\text{Sum of the length of glue lines on both butt ends}} \times 100$$

2 In measurement of delamination length, neither timber fracture caused by, for example, dried splits and knots, nor peeled-off portions where a knot is present shall be considered as delamination.

(4) Block Shear Tests

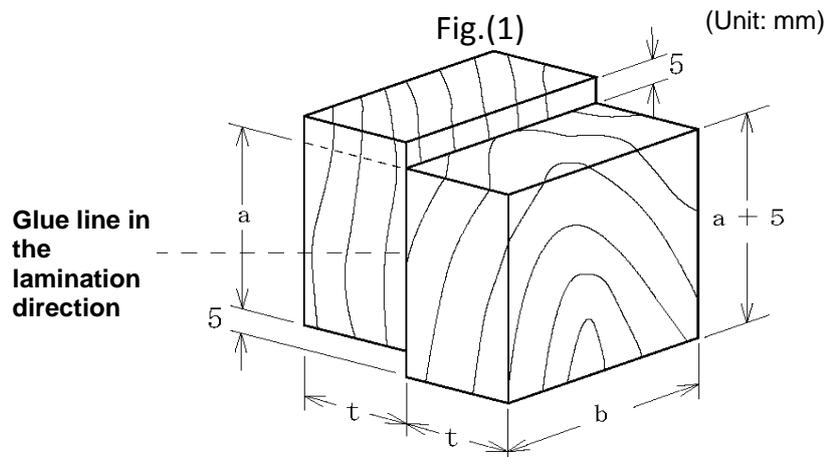
a Preparation of Test Specimens

(i) Decorative structural glued laminated timber post

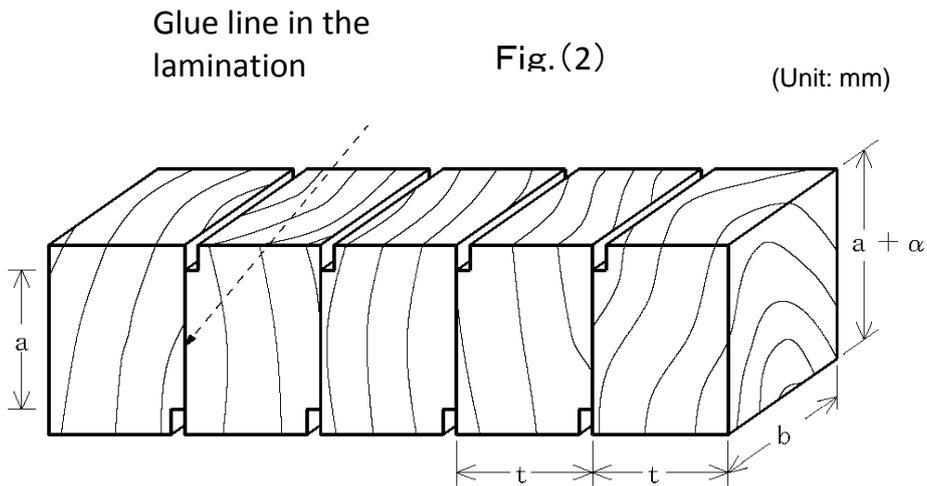
Test specimens shall be prepared from each sample glulam piece in such a shape as shown in Fig. (1) or Fig. (2) so that all glue lines in the lamination direction can be involved. The standard moisture content of the test specimen during the tests shall be 12%.

(ii) Structural glulams

One test specimen shall be prepared from each end of the sample glulam in the shape shown in Fig. (1) or Fig. (2) for all glue lines in the lamination direction, or in such a shape as shown in Fig. (3) for all glue lines in the lamina's width direction. However, in cases where no load is applied to the width direction of lamina, test specimens shall be prepared only for glue lines in the lamination direction. In addition, for secondary glue lines in the width direction, a required number of test specimens shall be prepared from the secondary adhesion layers of each sample glulam piece at the rate of one test specimen per 10 cm width of lamina for which secondary adhesion processes have not yet been initiated. For secondary adhesion of both the width direction and the lamination direction, a required number of test specimens shall be prepared not only from the above-mentioned secondary layers but also from the secondary adhesion layers of each sample glulam piece at the rate of one test specimen per 10 cm length of lamina. The standard moisture content of the test specimen during the tests shall be 12%



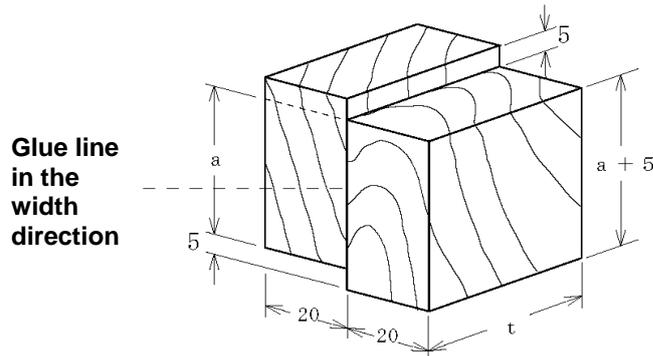
(Note) "a" and "b" shall be any length ranging from 25 mm to 55 mm.



(Note) "a" shall be any length ranging from 25 mm to 55 mm, "alpha" shall be an incision depth that is suitable for the device used, and "t" shall be the thickness of lamina.

Fig. (3)

(Unit: mm)



(Note) “a” shall be any length ranging from 25 mm and 55 mm and “t” shall be the thickness of lamina or the available maximum length of a lamina if the lamina’s shape is difficult to be measured.

b Testing Method

Test specimens shall be loaded up to fracture at a standard loading rate of around 9800 N per minute, not only using a testing machine with a loading capacity, a range between 15% and 85% of which shall include the breaking load of the test specimens, but also using a shearing machine designed to prevent any rotational moment from being exerted thereon and to keep the shearing surface of the specimens and the load axis parallel. The shear strength and wood failure rate of a test specimen shall be determined by the following equation:

$$\text{Shearing strength (Mpa or N/mm)} = \frac{\text{Maximum load at which a test specimen fails (N)}}{\text{Area of the adhesion portion (a} \times \text{b) (mm}^2\text{)}}$$

(Note) Test specimens having knots, resin pockets, and other defects in measuring areas may be removed from test specimens to be used for measurement. Thus, new test specimens shall be taken from other portion of the glue line area and then shall be retested. The results of the retest shall be determined.

(5) Moisture Content Tests

a Preparation of Test Specimens

Two test specimens of proper size shall be prepared from each sample glulam.

b Testing Method

After weighing, a test specimen shall be dried in a dryer at a temperature between 100° C and 105° C. When the test specimen is considered to have reached a constant mass (meaning when the difference between two mass values, each of which is measured at intervals of six hours, is not more than 0.1% of the mass of such test specimen, or meaning when it can be found that such condition has been achieved), the mass of such test specimen shall be again measured (this mass shall be hereinafter referred to as “bone dry mass”). Moisture content shall be calculated down to 0.1% by the following equation; an average of the moisture content of test specimens prepared from the same sample glulam shall be calculated down to 0.5%. However, other methods may also be used if they can clearly determine whether the test specimens satisfy standard criteria.

$$\text{Moisture content (\%)} = (W1 - W2) / W2 \times 100$$

Where: W1 represents predried mass (g)

W2 represents bone dry mass (g)

(6) Tests for Resistance to the Surface Check

a Preparation of Test Specimens

Two test specimens, each of which shall have a length of 150 mm and also have the same dimension as that of the butt-end cross-section of each sample glulam, shall be prepared from each full-sized piece of the sample glulam.

b Testing Method

After aluminum foil is glued to the butt end surface of a test specimen with rubber type adhesives, the test specimen shall be dried in a constant temperature dryer for twenty four hours at 60 ± 3° C.

(7) Bending Tests

a Bending Test A

(i) Preparation of Test Specimens or Model Specimens

For a straight glulam with a uniform cross section (excluding glulams for which actual size tests are difficult to be performed), a test specimen shall be prepared from the full-sized piece of each sample glulam. For other type glulams, one test specimen set forth in Subparagraph (a) shall be prepared from each side of every sample glulam in the width direction or the model specimen set forth in Subparagraph (b) shall be prepared. The standard moisture content of the test specimen during the tests shall be 12%.

a. Each test specimen shall meet the following requirements:

- (a) The thickness shall be half of that of the sample glulam.
- (b) The width shall be not less than half of that of the sample glulam.
- (c) The length shall be not less than twenty times the thickness thereof.
- (d) If the sample glulam has an end joint in its outermost layer, the test specimen shall be prepared so that it can include said end joint.

b. Any model specimen shall meet the following requirements:

- (a) The quality construction of its lamina shall be the same as that of the sample glulam.
- (b) The thickness shall be around 300 mm.
- (c) The width shall be the same as that of the sample glulam.

(ii) Testing Method

Using the approach shown in Fig. (4), upper- and lower-load limits between which a proportional relationship exists, the deflection corresponding to these loads, and the maximum load shall be measured to obtain Young's modulus of bending and bending strength. In this case, the same amount of load shall be applied to both loading points and the average loading rate shall not exceed 14.7 MPa/min. In addition, in a case where the correct direction for use is marked or labeled, the sample glulam shall be placed with its top surface upward; in other cases, the sample glulam shall be placed, for a mixed-grade composition glulam (symmetrical), with the loading direction perpendicular to lamination layers, for mixed-grade composition glulam (non-symmetrical), with the tensile side downward, for a same-grade composition glued laminated timber of which lamination is four (4) layers or more, with the loading direction perpendicular to the lamination layers, and, for a same-grade composition glued laminated timbered which lamination is two (2) or three (3), with the loading direction parallel to the lamination layers.

Note:

1. One span shall be not less than eighteen times the thickness of a sample glulam, test specimen, or model specimen.
2. Young's modulus of bending and bending strength shall be calculated by the following equations, respectively:

$$\text{Young's modulus of bending (Mpa or N/mm}^2\text{)} = \Delta P (\ell - S) (2\ell^2 + 2S - S^2) / 8 \Delta y b h^3$$

$$\text{Bending strength (MPa or N/mm}^2\text{)} = 3P_b (\ell - S) / 2bh^2$$

Where: ΔP represents a difference between the upper-limit and lower-limit loads in a range where a proportional relationship exists (N)

Δy is a deflection at center of span corresponding to ΔP (mm)

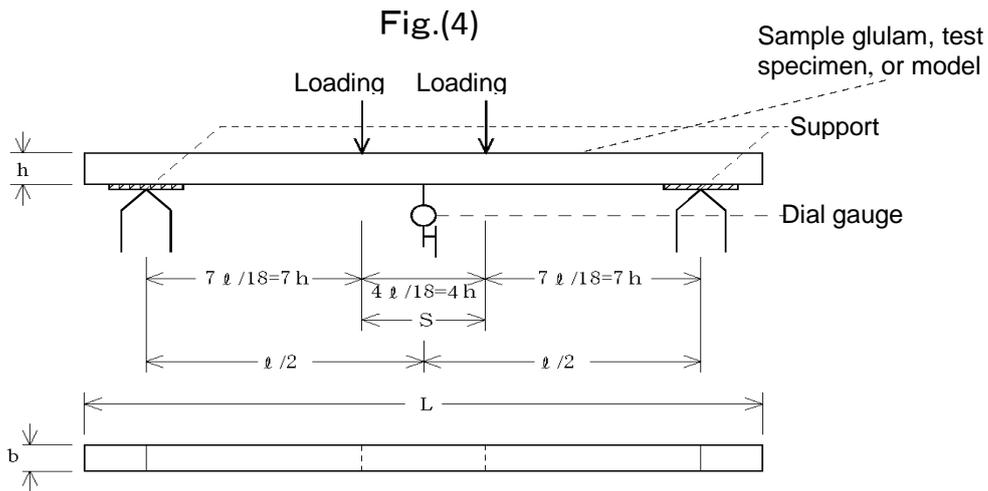
ℓ is a span (mm)

S is distance between loading points (mm)

b is the width of a sample glulam, test specimen, or model specimen (mm)

h is the thickness of the sample glulam, test specimen, or model specimen (mm)

P_b is the maximum load (N)



- l : span
- h : thickness of the sample glulam, test specimen, or model specimen
- S : distance between loading points
- b : width of the sample glulam, test specimen, or model specimen

b Bending Test B

(i) Testing Method

Using the approach shown in Fig. (5), the difference in deflections between deflection at initial loads and deflection at final load shall be measured to obtain Young's modulus of bending. The standard moisture content of the sample lamina during testing shall be 12%.

(Note) Young's modulus of bending shall be calculated by the following equation:

$$\text{Young's modulus of bending (Mpa or N/mm}^2\text{)} = \Delta P l^3 / 4 b h^3 \Delta y$$

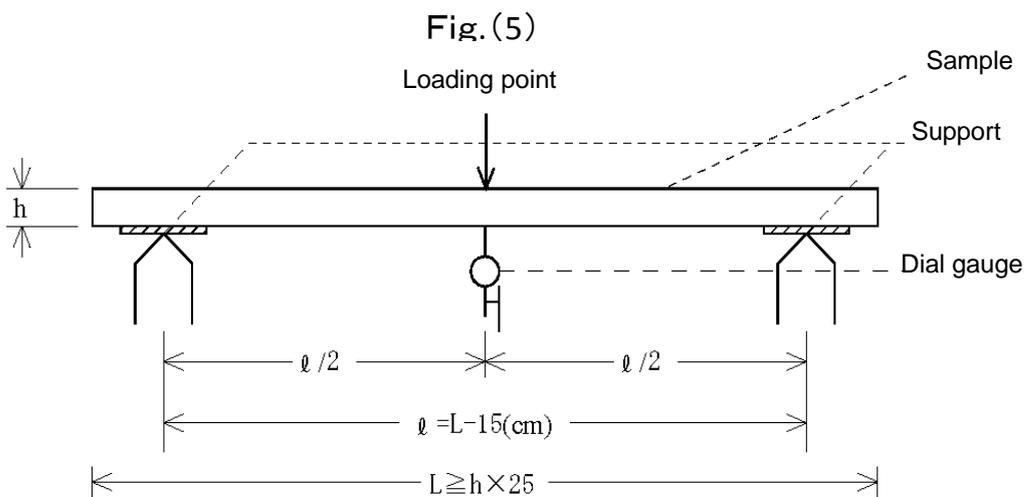
Where: ΔP is a difference between the initial load and final load (N)

Δy is a deflection at center of span corresponding to ΔP (mm)

l is a span (mm)

b is the width of a lamina (mm)

h is the thickness of the lamina (mm)



L : sample's length

l : span

h : sample's thickness

c Bending Test C

(i) Preparation of Test Specimens

A test specimen, which shall have a length of not less than 25 times the thickness and also have the same width and same thickness as that of a sample lamina shall be prepared from the sample lamina. However, for laminae with end joints, the test specimen shall be prepared so that the end joint can be positioned at the mid point along the length of said specimen. The standard moisture content of a test specimen during testing shall be 12%.

(ii) Testing Method

Using the approach shown in Fig. (6), the maximum load shall be measured to obtain the bending strength. In this case, the same amount of load shall be applied to both loading points and the average load speed shall not exceed 14.7 MPa/min.

(Note) Bending strength shall be calculated by the following equation:

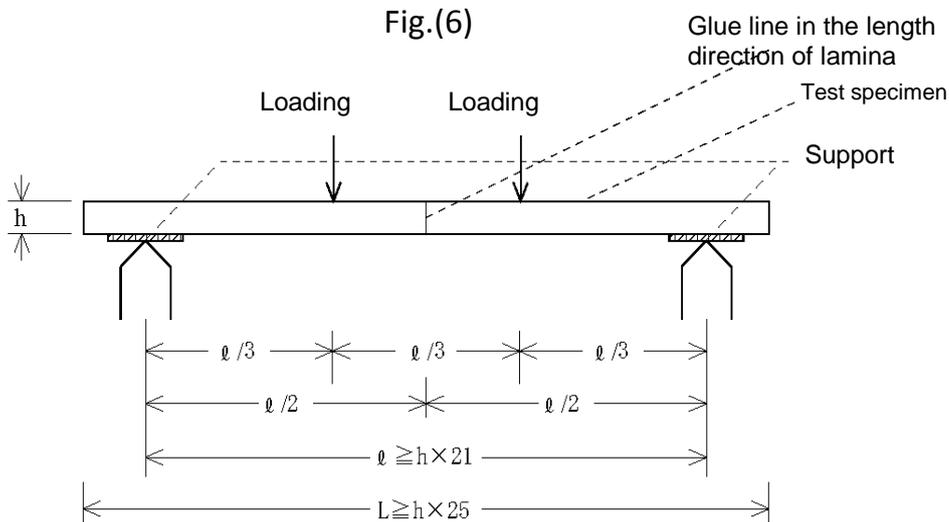
$$\text{Bending strength (MPa or N/mm}^2\text{)} = \frac{P_b \ell}{bh^2}$$

Where: P_b is the maximum load (N)

ℓ is the span of a test specimen (mm)

b is the width of the test specimen (mm)

h is the thickness of the test specimen (mm)



L: length of a sample glulam

ℓ : span

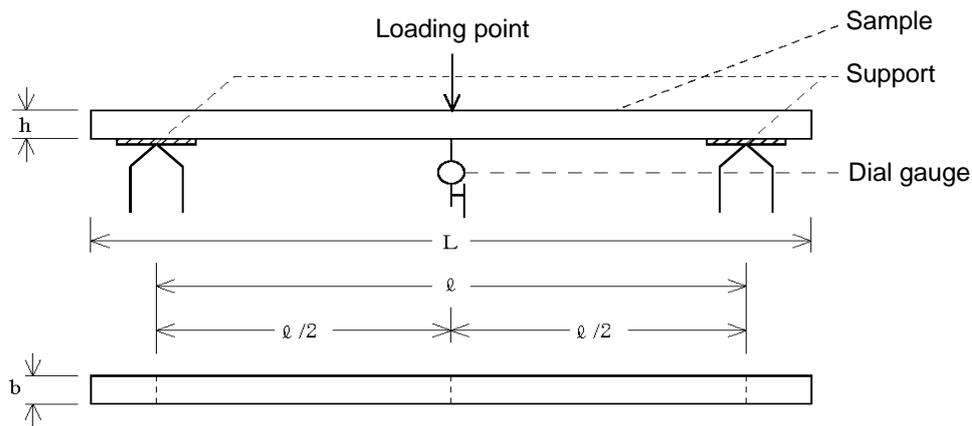
h: thickness of the sample glulam

d Bending test for decorative structural glued laminated timber posts

(i) Testing method

Bending tests shall be performed based on the approach shown in either Fig. (4) or Fig. (7). In this case, the loading direction shall be parallel to the lamination direction and the average loading speed shall be not exceed 14.7 MPa/min. In a case of using the approach shown in Fig. (4), the span shall be not less than eighteen times the thickness of a sample glulam; in a case of using the approach shown in Fig. (7), not less than fourteen times the thickness of the sample glulam. The standard moisture content of a test specimen during testing shall be 12%.

Fig. (7)



L: length of a sample glulam
 l : span
 h: thickness of the sample glulam
 b: width of the sample glulam

(Note)

1 When this test is to be performed using the approach shown in Fig. (4), the Young's modulus of bending and the bending strength shall be calculated by the following equations, respectively:

$$\text{Young's modulus of bending (MPa or N/mm}^2\text{)} = \Delta P (l - S) (2 l^2 + 2lS - S^2) / 8 \Delta y b h^3$$

$$\text{Bending strength (MPa or N/mm}^2\text{)} = 3Pb (l - S) / 2bh^2$$

Where: ΔP is the difference between the upper-limit and lower-limit loads in a range where a proportional relationship exists (N)

Δy is the deflection at the center of span corresponding to ΔP (mm)

l is the span (mm)

S is the distance between loading points (mm)

b is the width of a sample glulam (mm)

h is the thickness of the sample glulam (mm)

Pb is the maximum load (N)

2 When this test is to be performed using the approach shown in Fig. (7), Young's modulus of bending and the bending strength shall be calculated by the following equations, respectively:

$$\text{Young's modulus of bending (MPa or N/mm}^2\text{)} = \Delta P l^3 / 4bh^3 \Delta y$$

$$\text{Bending strength (MPa or N/mm}^2\text{)} = 3Pbl / 2bh^2$$

Where: ΔP is a difference between the upper-limit and lower-limit loads in a range where a proportional relationship exists (N)

Δy is a deflection at center of span corresponding to ΔP (mm)

l is a span (mm)

b is the width of a sample glulam (mm)

h is the thickness of the sample glulam (mm)

Pb is the maximum load (N)

(8) Tensile Test

a Preparation of Test Specimens

One test specimen from each sample lamina shall be made so that the specimen has the same width and thickness as that of the lamina and also has a length equal to that of both end grips plus 60 cm or longer. However, for laminae with end joints, the test specimen shall be made so that the end joint can be positioned in center of such specimen. The standard moisture content of a test specimen during testing shall be 12%.

b Test Method

Based on the method shown in Fig. (8), the length of test specimen's edges held by both end grips shall be 30 cm or longer and the span shall be 60 cm or longer. Tensile loads shall be applied through both end grips. In this case, an average loading speed shall be 9.8 MPa/minute or lower.

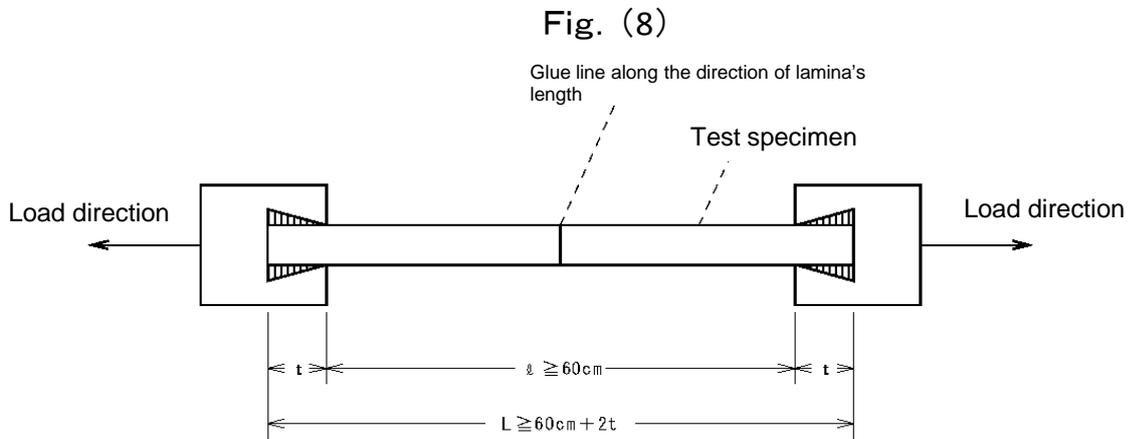
(Note) Tensile strengths shall be calculated by the following equation:

$$\text{Tensile strength (MPa or N/mm}^2\text{)} = P / bh$$

P is a maximum load (N)

b is the width of test specimen (mm)

h is the thickness of test specimen (mm)



(9) Formaldehyde Emission Amount Test

a Preparation of Test Specimens

The test specimen shall be cut from the portion of each glue laminated timber sample that is, in principle, 5 cm or more away from one end of the timber, with its cross-section dimensions maintained, to achieve a surface area of 450 cm² (excluding both of the butt ends). Both of the butt ends shall be sealed with self-adhesive aluminum tapes or paraffins that are impermeable to formaldehyde. In addition, in a case where the cross-section dimension or length of a test specimen is larger than the size of the test container, such original test specimen shall be cut into multiple smaller test specimens of the same shape; these smaller test specimens can be used instead.

In this case, the cutting surface of the test specimen shall also be sealed.

b Testing Method

(i) Curing of Test Species

All the test specimens cut from the same glued laminated timber sample shall be sealed in a plastic bag and then conditioned in a thermostatic chamber, etc. at a constant temperature of 20° C ± 1° C for one day or longer.

(ii) Preparation of Reagents

Each reagents shall be prepared according to the following items (a) through (h):

a Iodine Solution (0.05 mol/L)

At first, 40 g of potassium iodide (the same as specified in JIS K 8913 "Potassium iodide (Reagent)") is dissolved in 25 mL of water. 13 g of iodine (the same as specified in JIS K 8920 "Iodine (Reagent)") is then dissolved in the solution. The Iodine Solution shall be prepared by transferring the resulting solution into a 1,000 mL volumetric flask (the same as specified in JIS R 3503 "Glass apparatus for chemical analysis"; the same shall apply hereunder.), by adding three drops of hydrochloric acid (the same as specified in JIS K 8180 "Hydrochloric acid (Reagent)"), and dilute with water to the specified volume.

b Sodium Thiosulfate Solution (0.1 mol/L)

This sodium thiosulfate solution shall be prepared as follows: 26 g of sodium thiosulfate pentahydrate (the same as specified in JIS K 8637 "Sodium thiosulfate pentahydrate (Reagent)") and 0.2 g of sodium carbonate (the same as specified in JIS K 8625 "Sodium carbonate (Reagent)") are dissolved into 1,000 mL of water with no dissolved oxygen. After being left for two days, using potassium iodate (the same as specified in JIS K 8005 "Reference materials for volumetric analysis"), the solution shall undergo the standardization procedure specified in JIS K 8001 ("General rule for test methods of reagents"), 4.5 ("Solutions for titration") (21.1) "0.1 mol/L sodium thiosulfate solution."

c Sodium Hydroxide Solution (1 mol/L)

Shall be prepared by dissolving 40 g of sodium hydroxide (the same as specified in JIS K 8576 "Sodium hydroxide (Reagent)") with 200 mL of water, by transferring the resulting solution into a 1,000 mL volumetric flask, and dilute with water up to the 1,000 mL mark.

d Sulfuric Acid Solution (1 mol/L)

Shall be prepared by dissolving 56 mL of sulfuric acid (the same as specified in JIS K 8951 "Sulfuric acid (Reagent)") with 200 mL of water, by transferring the resulting solution into a 1,000 mL volumetric flask, and diluting with water up to the 1,000 mL mark.

e Starch Solution

This starch solution shall be prepared as follows: At first, 1 g of starch (the same as specified in JIS K 8659 "Starch (soluble)(Reagent)") shall be mixed well with 10 mL of water and then, the solution shall be added into 200 mL of boiling water while stirring. The resulting solution shall be boiled for about one minute, cooled down, and filtered to give this starch solution.

f Formaldehyde Standard Stock Solution

Shall be prepared by transferring 1 mL of formaldehyde solution (the same as specified in JIS K 8872 "Formaldehyde solution (Reagent)") into a 1,000 mL volumetric flask and diluting with water up to the 1,000 mL mark.

The formaldehyde concentration of this solution shall be calculated using the following steps: 20 mL of the above-mentioned formaldehyde standard stock solution shall be dispensed into a 100 mL stoppered Erlenmeyer flask (the same as specified in JIS R 3503 "Glass apparatus for chemical analysis"; the same shall apply hereunder.). After adding 25 mL of iodine solution of Item (a) and 10 mL of sodium hydroxide solution of Item (c) into the flask, the resulting solution shall be left for 15 minutes at room temperature under light-shielded conditions. Subsequently, after adding 15 mL of sulfuric acid solution of Item (d) into the flask, the liberated iodine shall be immediately titrated with sodium thiosulfate solution of Item (b). After observing a change in color (pale yellow) of the solution, 1 mL of starch solution of Item (e) shall be added as an indicator, and the titration shall be continued. Moreover, blank tests shall be performed using 20 mL of water. The concentration of formaldehyde shall be given by the following equation:

$$C = 1.5 \times (B - S) \times f \times 1,000/20$$

Where C is the concentration of formaldehyde in a formaldehyde standard stock solution (mg/L)

S is the titer of 0.1 mol/L sodium thiosulfate solution in the formaldehyde standard stock solution (mL)

B is the titer of 0.1 mol/L sodium thiosulfate solution in a blank test (mL)

f is a factor of 0.1 mol/L sodium thiosulfate solution

1.5 is the amount of formaldehyde equivalent to 1 mL of 0.1 mol/L sodium thiosulfate solution (mg)

g Formaldehyde Standard Solution

Shall be prepared by placing an appropriate amount of formaldehyde standard stock solution into a 1,000 mL volumetric flask and diluting with water up to the 1,000 mL mark.

5 mg, 50 mg, and 100 mg of formaldehyde shall be contained in 1,000 mL of water for Standard Solutions A, B, and C, respectively.

h Acetylacetone–Ammonium Acetate Solution

This acetylacetone–ammonium acetate solution shall be prepared as follows: At first, 150 g of ammonium acetate (the same as specified in JIS K 8359 “Ammonium acetate (Reagent)”) shall be dissolved with 800 mL of water. Next, 3 mL of glacial acetic acid (the same as specified in JIS K 8355 “Acetic acid (Reagent)”) and 2 mL of acetylacetone (the same as specified in JIS K 8027 “Acetylacetone (Reagent)”) shall be added to and mixed well in the solution. Further, dilute with water to a final volume of 1,000 mL. (When immediate measurements are not possible, this solution can be stored in a cool place (0°C – 10°C) for up to three days after its preparation.)

(iii) Formaldehyde emission collection

As shown in Fig. (9), place 20 ml of distilled water in a small lidded polypropylene or polyethylene collection reservoir with an inner diameter of 57 mm and a height of 50–60 mm, water, shall be placed at the center of the bottom of about 40L test vessel made of acrylic resin (limited only to those capable of ensuring air tightness).

A test specimen shall be placed on top of the container (When there are a plurality of test specimens, as shown in Fig. (9), such specimens shall have to be fastened with support fittings in such a position that they cannot come in contact with each other) and shall be left at $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$ for 24 hours -0 and $+5$ minutes while the emitted formaldehyde is allowed to be absorbed into distilled water, which provides the sample solution.

Moreover, in order to measure the background concentration of formaldehyde, the above–mentioned steps shall be performed in such a state that no test specimen is present in the test vessel. The resulting solution shall be used as a background solution.

(Note) Except when trapping formaldehyde, introducing distilled water into a water collection container and taking out distilled water from the water collection container, in order to prevent formaldehyde present in the air from being adsorbed to the water collection container or being absorbed into the distilled water inside the container, such water shall need to have an inner lid.

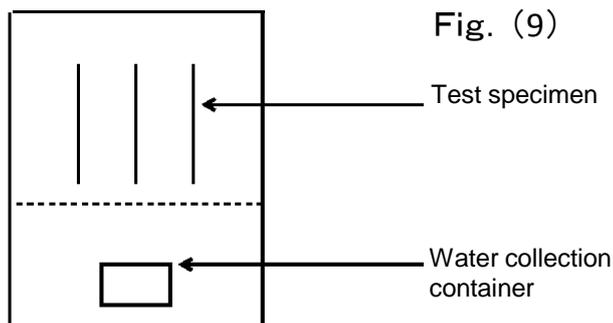


Fig. (9)

(iv) Procedure for measuring formaldehyde concentration

Concentrations of formaldehyde in a sample solution and a background solution shall be measured using an acetylacetone absorption spectrophotometry. At first, 10 mL of the sample solution specified in Section (iii) shall be placed into a stoppered container. Subsequently, 10 mL of acetylacetone–ammonium acetate solution shall be added to the container and mixed, with the container stoppered. After the stoppered container is heated in a warm water bath (at $65^{\circ}\text{C} \pm 2^{\circ}\text{C}$) for 10 minutes, this solution shall be left still under a light shielding condition until it reaches room temperature. This solution shall be transferred into an absorption cell. Next, a spectrophotometer shall be used to measure the absorbance at a wavelength of 412 nm (using water as a control).

In addition, if the concentration of such a sample solution is too high to achieve accurate measurements, 5 mL of the remaining sample solution shall be diluted 4–5 times with water. This diluted solution shall be used instead for the measurements according to the above–mentioned steps.

(v) Preparation of Calibration Curves

In preparing calibration curves, 0 mL, 2.0 mL, 4.0 mL, and 6.0 mL of three types of formaldehyde standard solutions shall be dispensed by a one-mark pipette (the same as specified in JIS R 3505 "Volumetric Glassware") and placed in each 100 mL one-mark flask. Water shall be subsequently added to bring the volume to 100 mL, thereby providing formaldehyde solutions for preparing calibration curves. Formaldehyde concentrations shall be: 0 mg/L, 0.1 mg/L, 0.2 mg/L, and 0.3 mg/L for Standard Solution A; 0 mg/L, 1.0 mg/L, 2.0 mg/L, and 3.0 mg/L for Standard Solution B; 0 mg/L, 2.0 mg/L, 4.0 mg/L, and 6.0 mg/L for Standard Solution C. All of these solutions shall be dispensed 25 mL each and undergo the procedures given in the above Section (iv), obtaining the relationship line between formaldehyde amount and absorbance. The slope of the line (F) may be graphically obtained or may be calculated. In addition, those standard solutions A, B, and C shall be chosen for use depending on the estimated concentration of a sample solution.

(vi) Calculation of Formaldehyde Concentration

The concentration for a sample solution shall be calculated by the following equation:

$$G = F \times (A_d - A_b) \times (1/3.75)$$

Where: G is the formaldehyde concentration in the test specimen (mg/L)
 A_d is the absorbance of the sample solution
 A_b is the absorbance of a background solution
 F is a slope of a calibration curve (mg/L)
 (1/3.75) is a conversion factor for formaldehyde concentration

Labeling Format (relating to Articles 3, 4, and 6)

Name of product			
Wood species	for the core material	for the decorative surface veneer	
Thickness of the decorative			
Surface veneer			
Visible Surface	Shorter side	Longer side	Length of the timber
Formaldehyde emission amount			
Types of adhesive used, etc.			
Manufacturer			

Remarks

- 1 When using this format for a glued laminated timber for fixtures, the phrases "For the core material," "For the decorative surface veneer," and "Thickness of the decorative surface veneer" shall be deleted.
- 2 When using this format for any glulam with no indication of formaldehyde emissions, the phrase "Formaldehyde emission level" shall be deleted from the format.
- 3 When using this format for any glulam and not indicating that a non-formaldehyde-type adhesive is used therein, the phrase "Types of adhesive used, etc." shall be deleted from the format.
- 4 If labeling is made by a seller, the word "Manufacturer" shall be replaced with "Seller."
- 5 For imported goods notwithstanding the provisions in Item 4, the "Manufacturer" in this format shall be replaced with "Importer."
- 6 This format may be written vertically.

Labeling Format (relating to Article 5)

Name of product	
Strength grade	
Quality of surface	
Bonding performance	
Wood species	
Dimensions	
Number of lamina's	
Inspection method	

Formaldehyde emission amount	
Actual size strength	
Proof loader	
Types of adhesive used, etc.	
Manufacturer	

Remarks

1. When using this format for any glulam without veneer surface, the phrase “Number of lamina” shall be deleted from the format.
2. When using this format for any glulam and the phrase “bending performance testing conducted” is not indicated, the phrase “Inspection method” shall be deleted from the format.
3. When using this format for any glulam with no indication of formaldehyde emissions, the phrase “Formaldehyde emission level” shall be deleted from the format.
4. When using this format for any glulam with no indication that simulation calculations have been performed along with full scale strength tests or verification tests, the phrase “Full scale strength test” shall be deleted from the format.
5. When using this format for any glulam with no indication that strength has been verified with a proof loader, the phrase “Proof loader” shall be deleted from the format.
6. When using this format for any glulam with no indication that a non-formaldehyde-type adhesive is used therein, the phrase “Types of adhesive used, etc.” shall be deleted from the format.
7. If labeling is made by a seller, the word “Manufacturer” shall be replaced with “Seller.”
8. For imported goods, notwithstanding the provisions in Item 7, “Manufacturer” in this format shall be replaced with “Importer.”
9. This format may be written vertically.

Supplementary Provisions (Notification No. 1152 of MAFF (Ministry of Agriculture, Forestry and Fisheries), September 25, 2007)

(Enforcement Date)

Article 1. This Notification shall go into effect 90 days after the date of promulgation.

(Revocation of the Japanese Agricultural Standard for Structural Glued Laminated Timber)

Article 2. The Japanese Agricultural Standard for Structural Glued Laminated Timber (Notification No. 111 of MAFF, January 29, 1996) shall be revoked.

(Interim Measure in Conjunction with Revision of the Japanese Agricultural Standard for Glued Laminated Timber)

Article 3. At the time when this Notification comes into effect, any glued laminated timber marked with a grade based on the Japanese Agricultural Standard for Glued Laminated Timber (before the revision according to this Notification) shall still be based on the previous standard.

(Interim Measure in Conjunction with Revocation of the Japanese Agricultural Standard for Structural Glued Laminated Timber)

Article 4. At the time when this Notification comes into effect, any structural glued laminated timber marked with

a grade based on the Japanese Agricultural Standard for Structural Glued Laminated Timber (before the revision according to this Notification) shall still be based on the previous standard.