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Foundation wood sill treated with preservatives by pressure processes

1 Scope This Japanese Industrial Standard specifies the wood treated with preservatives by pressure processes for the purpose of using as the foundation wood sill of buildings (hereafter referred to as "preservative treated foundation wood sill").

Remarks Normative references in this Standard are listed in Attached Table 1.

2 Definitions The definitions of main terms used in this Standard are as follows.

- (1) **end check** Splits found on the end surface of wood.
- (2) **ring shake** Shakes along the annual ring of wood.
- (3) **curve** The curve found on the side face of thickness in the longitudinal direction.
- (4) **torsion** The phenomenon that four corners of a wood are not on the same plane because of its twisting.
- (5) **warp** A generic term including warp (warp in the direction of thickness), width warp (warp in the direction of width), torsion, and so on.
- (6) **incising** In order to get the uniform permeation layer of wood preservatives, the process to incise the wood surface prior to injection treatment.
- (7) **curing** After pressurized injection treatment, the process to be taken for drying the preservative treated foundation wood sill to the extent that any impediment does not occur in handling it, or for fixing the ingredients of the wood preservatives in the foundation wood.

3 Quality

3.1 End check, curve and torsion The through fissures at the end surface of preservative treated foundation wood sill shall not be more than 2.0 times of wood thickness, the curve not be more than 0.5 % and in addition to those, the torsion not be detrimental to use.

Remarks The end check and curve shall be measured according to, in case of coniferous tree, the method specified in "Japanese Agricultural Standard for structural lumber of coniferous tree", and in case of broadleaf tree, the method specified in "Japanese Agricultural Standard for lumber of broadleaf tree".

3.2 Degree of permeation The permeation degree of wood preservatives shall be

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80 % or more.

3.3 Absorbed amount The absorbed amount of wood preservatives shall be as shown in Table 1.

Table 1 Specification of absorbed amountUnit : kg/m³

Classification of wood preservatives		Symbol	Absorbed amount
Chromium, copper, and arsenic compound type wood preservatives	No.1	CCA-1	3.5 to 10.5
	No.2	CCA-2	
	No.3	CCA-3	
Alkylammonium compound type wood preservatives		AAC	4.5 min.(as DDAC)
Emulsifying copper naphthenate type wood preservatives		NCU	1.0 min.(as Cu)
Emulsifying zinc naphthenate type wood preservatives		NZN	2.0 min.(as Zn)
Copper and alkylammonium compound type wood preservatives	No.1	ACQ-1	2.6 min.
	No.2	ACQ-2	

4 Dimension and tolerance

4.1 Standing store The dimensions of standing store shall be as shown in Table 2.

Table 2 Dimensions and tolerance of standing store

Unit : cm

Length	Thickness	Width	Tolerance
300	9.0	9.0	The plus side tolerance of length, thickness, and width is not specified, but their minus side tolerance is not allowed.
400	10.5	10.5	
	10.5	12.0	
	12.0	12.0	

4.2 Articles to be made by order The length, thickness, and width of article to be made by order shall be subject to the agreement between the parties concerned with delivery, and their tolerance shall follow Table 2.

5 Materials

5.1 Wood The quality of wood shall be as follows.

5.1.1 Kind of wood The kind of wood shall be hemlock fir, EZOMATU, white fir and apitong.

5.1.2 Quality

(1) **Hemlock fir, EZOMATU and white fir** The criteria of hemlock fir, EZOMATU

and white fir shall be as shown in Table 3.

Table 3 Quality criteria for hemlock fir, EZOMATU and white fir

Item of defect			Criteria
Knots (except knots grouped)	Narrow wood surface		Ratio of diameter ⁽¹⁾ shall be 60 % or less.
	Wide wood surface	Wood edge	Ratio of diameter shall be 35 % or less.
		Wood center	Ratio of diameter shall be 70 % or less.
Knots (knots grouped)	Narrow wood surface		Ratio of diameter ⁽²⁾ shall be 90 % or less.
	Wide wood surface	Wood edge	Ratio of diameter shall be 50 % or less.
		Wood center	Ratio of diameter shall be 90 % or less.
Wane			It shall be 30 % or less.
Through fissures (wood end)			It shall be 2.0 times of wood width or less.
Through fissures (wood surface)			It shall be 1/3 of wood length or less.
Inclination ratio of fiber direction			It shall be 1:6 or less.
Average width of annual rings			It shall be 10 mm or less.
Rot			It shall not exist.
Curve			It shall be 0.5 % or less.
Warp and other defects			They shall not be detrimental to use.
Incising			Incising is not regarded as a defect. But its specification shall be in the range that the bending strength and Young's coefficient of wood does not decrease by more than about 10 %.

Notes ⁽¹⁾ The ratio of knot diameter is percentage of the knot diameter to the width of wood surface where the knot exists.

⁽²⁾ The ratio of knot diameter of grouped is the total ratio of the diameter of knots existing in 15 cm length of wood surface.

(2) **Apitong** The criteria of apitong shall be as shown in Table 4.

Table 4 Quality criteria for apitong

Item of defects	Criteria
Knots	The maximum ratio of a knot shall be 10 % or less, and its number per 2 m longitudinal interval of wood(odd interval shall be included)shall be one or less.
Wane	It shall be 10 % or less.
End check or ring shake	It shall be 10 % or less.
Season crack	It shall be slight.
Curve, warp, or torsion	It shall be slight.
Worm hole	It shall be very slight.
Rot	It shall be very slight.
Other defects	It shall be slight.
Incising	Incising is not considered as a defect. But its specification shall be in the range that the decrease of bending strength or the decrease of Young's coefficient shall not exceed 10 % approximately.

5.2 Wood preservatives The wood preservatives to be used shall be "chromium, copper, and arsenic compound type wood preservatives", "alkylammonium compound type wood preservatives", "emulsifying copper naphthenate type wood preservatives", "emulsifying zinc naphthenate type wood preservatives", or "copper and alkylammonium compound type wood preservatives", specified in JIS K 1570.

6 Manufacturing method

6.1 Treatment method by pressurizing injection The treatment method by pressurizing injection shall follow the method specified in JIS A 9002.

6.2 Curing Curing shall be as follows.

- (1) When treated by pressurizing injection using the chromium, copper and arsenic compound type wood preservatives, the curing term not less than 20 days shall be taken after the pressurizing injection treatment.

If the curing by heating is carried out under the condition capable of obtaining the curing effect equivalent or superior thereto, this term may be shortened.

- (2) When treated by pressurizing injection using other wood preservatives than chromium, copper, and arsenic compound type wood preservatives, the curing period shall be taken at least 7 days after the pressurizing injection treatment.

If the artificial drying is carried out under the condition capable of obtaining the curing effect equivalent or superior thereto, this term may be shortened.

7 Test method

7.1 Sampling method of test piece The test piece shall be taken up to the depth of 10 ± 0.5 mm using the increment borer (internal diameter of 4.45 mm to 4.54 mm) at right angle to the wood surface of the preservative treated foundation wood sill at the middle part of width on the surface lying at the middle of the length where the heart wood is exposed or the least sapwood exists.

7.2 Degree of permeation The degree of permeation shall be obtained by the following formula after measuring the length of permeation of wood preservatives using vernier caliper with the minimum graduation of 1/10 mm or less.

$$P = \frac{L}{10} \times 100$$

where, P : degree of permeation (%)

L : length of permeation (mm)

The measurement of the length of permeation shall be as follows.

- (1) **That treated with chromium, copper and arsenic compound type wood preservatives** Wet the outside surface of test piece with the indicator made from the

water of 50 ml into which 0.5 g of 1, 5-diphenylcarbonohydrazide specified in JIS K 8488 and 50 ml of 2-propanol specified in JIS K 8839 are dissolved, measure the length of the part where the color changed to maroon and take its value as the length of permeation.

- (2) **That treated with alkylammonium compound type wood preservatives** Wet the outside surface of test piece with 3 mol/l acetic acid solution prepared using the acetic acid specified in JIS K 8355 and allow to stand as it is for 3 min, and then wet it with acetone solution of bromophenol blue (2 g/l) prepared using the bromophenol blue specified in JIS K 8844 and the acetone specified in JIS K 8034 and allow to stand as it is for some 5 min. Measure the length of the part that presented blue color and make its value the length of permeation.
- (3) **That treated with emulsifying copper naphthenate type wood preservatives** Wet the outside surface of test piece with the indicator made from 50 ml of water into which 0.5 g of 1,5-diphenylcabonohydrazide specified in JIS K 8488 and the 50 ml of 2-propanol specified in JIS K 8839 are dissolved and measure the length of the part where the color changed to blueish purple to make its value the length of permeation.
- (4) **That treated with emulsifying zinc naphthenate type wood preservatives** Wet the outside surface of test piece with acetone solution of dithizone (1 g/l) prepared using the dithizone specified in JIS K 8490 and the acetone specified in JIS K 8034 and measure the length of the part where the color changed to red to make its value the length of permeation.
- (5) **That treated with copper and alkylammonium compound type wood preservatives** Wet the outside surface of test piece with the indicator made by dissolving 0.5 g of chrome azurol S and 5 g of sodium acetate specified in JIS K 8372 into 500 ml of water and measure the length of the part where the color changed to dark green to make its value the length of permeation.

7.3 Absorbed amount The measurement of absorbed amount shall follow Annex. For the measurement of the absorbed amount, test pieces which have been used in permeation length measurement shall be used as samples.

8 Inspection

8.1 Dimensions, end check, curve, and torsion The inspection on dimensions, end check, curve, and torsion shall be done in accordance with rational sampling inspection, and the results shall comply with the requirements in 3.1 and 4.

8.2 Degree of permeation The inspection of permeation degree shall be done in accordance with rational sampling inspection, and the results shall comply with the requirements in 3.2.

8.3 Absorbed amount The inspection of absorbed amount shall be done in accordance with rational sampling inspection, and the results shall comply with the require-

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ments in 3.3.

9 Designation of products The products shall be designated by the kind of wood, dimensions, and the symbol for the name of wood preservatives.

Example : Hemlock—400×10.5×10.5—CCA—1

10 Marking On products, the following items shall be marked.

- (1) Kind of wood
- (2) Dimensions (length, thickness, and width)
- (3) Kind of wood preservative or its symbol
- (4) Name of manufacturer or its abbreviation
- (5) Year of manufacture or its abbreviation

11 Precaution for handling On catalogue or the like, the precaution for handling of preservative treated foundation wood sill shall be described.

Attached Table 1 Normative references

Standard No.	Title
JIS A 9002	<i>Preservative treatments of woods by pressure processes</i>
JIS K 0010	<i>Copper standard solution</i>
JIS K 0011	<i>Zinc standard solution</i>
JIS K 0050	<i>General rules for chemical analysis</i>
JIS K 0102	<i>Testing methods for industrial wastewater</i>
JIS K 0115	<i>General rules for molecular absorptiometric analysis</i>
JIS K 0119	<i>General rules for X-ray fluorescence spectrometric analysis</i>
JIS K 0121	<i>General rules for atomic absorption spectrochemical analysis</i>
JIS K 1570	<i>Wood preservatives</i>
JIS K 8001	<i>General rule for test methods reagents</i>
JIS K 8012	<i>Zinc</i>
JIS K 8019	<i>Sodium nitrite</i>
JIS K 8034	<i>Acetone</i>
JIS K 8044	<i>Diarsenic trioxide</i>
JIS K 8085	<i>Ammonia solution</i>
JIS K 8101	<i>Ethanol (99.5)</i>
JIS K 8102	<i>Ethanol (95)</i>
JIS K 8107	<i>Disodium dihydrogen ethylenediamine tetraacetate dihydrate</i>
JIS K 8136	<i>Tin (II) chloride dihydrate</i>
JIS K 8138	<i>Copper (I) chloride</i>
JIS K 8150	<i>Sodium chloride</i>
JIS K 8180	<i>Hydrochloric acid</i>
JIS K 8230	<i>Hydrogen peroxide</i>
JIS K 8247	<i>Potassium permanganate</i>
JIS K 8284	<i>Diammonium hydrogen citrate</i>
JIS K 8322	<i>Chloroform</i>

Attached Table 1 (concluded)

Standard No.	Title
JIS K 8355	<i>Acetic acid</i>
JIS K 8359	<i>Ammonium acetate</i>
JIS K 8371	<i>Sodium acetate</i>
JIS K 8372	<i>Sodium acetate</i>
JIS K 8374	<i>Lead (II) acetate trihydrate</i>
JIS K 8377	<i>Butyl acetate</i>
JIS K 8454	<i>Sodium N, N-diethyldithiocarbamate trihydrate</i>
JIS K 8488	<i>1, 5-diphenylcarbonohydrazide</i>
JIS K 8490	<i>Dithizone</i>
JIS K 8517	<i>Potassium dichromate</i>
JIS K 8541	<i>Nitric acid</i>
JIS K 8576	<i>Sodium hydroxide</i>
JIS K 8580	<i>Tin</i>
JIS K 8622	<i>Sodium hydrogen carbonate</i>
JIS K 8660	<i>Copper</i>
JIS K 8731	<i>Urea</i>
JIS K 8832	<i>Brucine n-hydrate</i>
JIS K 8839	<i>2-Propanol</i>
JIS K 8844	<i>Bromophenol blue</i>
JIS K 8889	<i>Metacresol purple</i>
JIS K 8913	<i>Potassium iodide</i>
JIS K 8951	<i>Sulfuric acid</i>
JIS K 8953	<i>Zinc sulfate heptahydrate</i>
JIS K 8979	<i>Ammonium iron (II) sulfate hexahydrate</i>
JIS K 8983	<i>Copper (II) sulfate pentahydrate</i>
JIS K 8987	<i>Sodium sulfate</i>
JIS K 9005	<i>Phosphoric acid</i>
JIS K 9512	<i>Silver N, N-diethyldithiocarbamate</i>

Related standards :

Japanese Agricultural Standard for structural lumber of coniferous tree
 Japanese Agricultural Standard for lumber of broadleaf tree

Annex Measuring method for absorbed amount of wood preservatives

1 Scope This Annex specifies the method to measure the amount of wood preservatives absorbed in preservative treated wood.

2 General matters The general matters commonly applied in this Annex, unless otherwise provided, conform to JIS K 0050, JIS K 0121, and JIS K 0115.

3 Testing method

3.1 That treated with chromium, copper, and arsenic compound type wood preservatives The absorbed amount of chromium, copper, and arsenic compound type wood preservatives is obtained by determination of contents of chromium, copper, and arsenic in sample. The determination methods shall follow any one of, atomic absorption spectrometry, absorptiometry, X-ray fluorescence spectrometric analysis, and titrimetry.

3.1.1 Atomic absorption spectrometry The atomic absorption spectrometry shall be as follows.

(1) **Reagents** Reagents shall be as follows.

- (a) **Sulfuric acid** Specified in JIS K 8951.
- (b) **Sulfuric acid (1+4)** Prepared using sulfuric acid specified in JIS K 8951.
- (c) **Hydrogen peroxide** Specified in JIS K 8230.
- (d) **Sodium sulfate solution (30 g/l)** Prepared using sodium sulfate (anhydrous) specified in JIS K 8987.
- (e) **Sulfuric acid—sodium sulfate solution** Add 8 ml of sulfuric acid into 100 ml of sodium sulfate solution (30 g/l), and add water to make up the volume to 1 000 ml.
- (f) **Stock solution for working curve (1 000 mg Cr/l, 500 mg Cu/l, 1 000 mg As/l)** Weigh respectively 1.415 g of potassium dichromate specified in JIS K 8517, 0.983 g of copper (II) sulfate pentahydrate specified in JIS K 8983, and 0.660 g of diarsenic trioxide specified in JIS K 8044, put them into a 300 ml beaker, add 25 ml of water, 10 ml of hydrogen peroxide, and 4 ml of sulfuric acid, and heat gradually it on a sand bath to dissolve them. After cooling it, transfer it into a 500 ml volumetric flask, wash inside of the beaker with water, and put it together into the volumetric flask. Add 50 ml of sodium sulfate solution (30 g/l) using a transfer pipet, and add water up to the mark line.
- (g) **Solution for working curve** Take 10 ml of the stock solution for working curve into a 100 ml volumetric flask with a transfer pipet, and add sulfuric acid—sodium sulfate solution up to the mark line. Take stepwise 0, 1, 3, 5, 10, 15 ml of this solution into as many 100 ml volumetric flasks using a transfer pipet, and add re-

spectively sulfuric acid – sodium sulfate solution up to the mark line.

(2) **Apparatus** An atomic absorption spectrometer shall be used.

(3) **Procedures** Procedures shall be as follows.

- (a) Put 10 pieces of samples into a 500 ml round-bottomed flask equipped with an interchangeable ground trapping bulb, add 10 ml of hydrogen peroxide and 2 ml of sulfuric acid, and heat it gradually on a sand bath to decompose the contents. When the contents of the flask become about 2 ml, add 5 ml of hydrogen peroxide. Repeat this procedure to decompose the samples completely and until the contents become transparent green, finally concentrate it to about 2 ml, then allow it to cool.
- (b) Transfer the contents into a 500 ml volumetric flask while washing with water, add 10 ml of sulfuric acid (1+4) and 50 ml of sodium sulfate solution (30 g/l), and add water up to the mark line, to make it sample solution.
- (c) In compliance with 6 of JIS K 0121, spray the sample solution into a flame, measure its absorbance, and obtain the concentrations of chromium, copper, and arsenic in the sample solution using working curve ⁽¹⁾. Then, calculate the amount of chromium compound, copper compound, and arsenic compound in the sample solution according to the following formula. In this case, the flame and wavelength for measurement of each component shall be as shown in Annex Table 1.

Note ⁽¹⁾ If the absorbance of sample solution exceeds the maximum concentration of the working curve, the working curve shall not be prolonged. In this case, appropriately dilute sample solution with sulfuric acid – sodium sulfate solution, and then remeasure its absorbances.

$$K_0 = \frac{K \times 1.923 \times v}{1\,000}$$

$$D_0 = \frac{D \times 1.252 \times v}{1\,000}$$

$$H_0 = \frac{H \times 1.534 \times v}{1\,000}$$

where,

- K_0 : mass of chromium compound (as CrO_3) in sample solution (mg)
- D_0 : mass of copper compound (as CuO) in sample solution (mg)
- H_0 : mass of arsenic compound (as As_2O_5) in sample solution (mg)
- K : concentration of chromium in sample solution (mg Cr/l)
- D : concentration of copper in sample solution (mg Cu/l)
- H : concentration of arsenic in sample solution (mg As/l)
- v : diluted quantity of decomposed sample (ml)

1.923 : conversion factor of Cr to CrO_3

1.252 : conversion factor of Cu to CuO

1.534 : conversion factor of As to As_2O_5

Remarks The preparation of working curve shall be as follows.

Carry out the same procedures on the solution for working curve, and plot the relation between concentrations of respective chromium, copper, and arsenic and each indicated value, to prepare the working curve. Prepare the working curve at every measurement.

Annex Table 1 Flame and wavelength for measurements of each component

Component	Flame	Wavelength for measurement ⁽²⁾ nm
Chromium	Air-acetylene	357.9 or 429.0
Copper	Air-acetylene	324.8
Arsenic	Argon-hydrogen	193.7 or 197.2

Note ⁽²⁾ When measuring chromium or arsenic, either wavelength may be used, however, the same wavelength shall be employed through a series of analysis.

- (4) **Calculation of absorbed amount** Absorbed amount shall be calculated according to the following formula making use of result in (3).

$$R = \frac{P}{1.59} \times \frac{1}{\varepsilon}$$

where, R : absorbed amount (kg/m^3)

P : K_0 , D_0 or H_0

1.59 : volume of sample (cm^3)

ε : factor for calculating of absorbed amount from determined value of each component, and as shown in Annex Table 2

Annex Table 2 Factor for calculation of absorbed amount

Compound	Type of wood preservatives		
	No.1	No.2	No.3
Chromium compound	0.655	0.353	0.475
Copper compound	0.181	0.196	0.185
Arsenic compound	0.164	0.451	0.340