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Extruded cement panel

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Foreword

This Japanese Industrial Standard has been revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Extruded Cement Panel Association (ECP)/Japanese Standards Association (JSA) with a draft being attached, based on the provision of Article 12, paragraph (1) of the Industrial Standardization Act applied mutatis mutandis pursuant to the provision of Article 16 of the said Act. This edition replaces the previous edition (**JIS A 5441** : 2003), which has been technically revised.

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Extruded cement panel

1 Scope

This Japanese Industrial Standard specifies requirements for extruded cement panels (hereafter referred to as ECP) mainly applied to non-proof-stress external walls and partition walls of buildings, which are manufactured by extruding the main materials of cement, siliceous material and fibrous material into a plate with hollow parts inside, and then autoclave-curing it.

2 Normative references

Part or all of the provisions of the following standards, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1321 *Testing method for incombustibility of internal finish material and procedure of buildings*

JIS A 1414-2 *Performance test methods of panel components for building construction — Part 2 : Tests for mechanical properties*

JIS A 1435 *Method of test for resistance of exterior materials of buildings to freezing and thawing*

JIS A 5758 *Sealants for sealing and glazing in buildings*

JIS A 9504 *Man made mineral fibre thermal insulation materials*

JIS B 7507 *Geometrical product specifications (GPS) — Dimensional measuring equipment — Vernier, dial and digital callipers*

JIS B 7512 *Steel tape measures*

JIS B 7516 *Metal rules*

3 Terms and definitions

For the purpose of this Standard, the following terms and definitions apply.

3.1

fibrous material

pulp, glass fibre or the like

Note 1 to entry Fibrous material shall not include asbestos.

3.2

extrusion moulding

moulding method in which material is continuously extruded into a plate through a

mould of a desired shape

3.3

working width

dimension consisting of the product width and 1/2 the joint width added at both ends of the product width

Note 1 to entry See Figure 2.

4 Classification and symbols

ECPs are classified as shown in Table 1 according to their surface configuration and whether their hollow parts are filled with rock wool material.

Table 1 Classification of ECP products

Classification of ECP	Symbol	Remarks
Flat panel	F	Panel with smooth surface
Flat panel [with rock wool filling ^{a)}]	F/R	
Design panel	D	Panel with ribs or uneven surface design similar to ribs
Design panel [with rock wool filling ^{a)}]	D/R	
Embossed panel	E	Panel with embossed surface
Embossed panel [with rock wool filling ^{a)}]	E/R	
Tile base flat panel	TF	Panel with smooth surface for tile adhesive facing
Tile base flat panel [with rock wool filling ^{a)}]	TF/R	
Tile base panel	T	Panel with surface dovetail-grooved for tiling
Tile base panel [with rock wool filling ^{a)}]	T/R	
Note ^{a)} Rock wool used for ECP products shall conform to JIS A 9504 .		

5 Shape and dimensions

5.1 Shape

Examples of shapes of ECP are shown in Figure 1. An example of product width and thickness is shown in Figure 2, and examples of dovetail groove configuration on the tile base panel surface are shown in Figure 3.

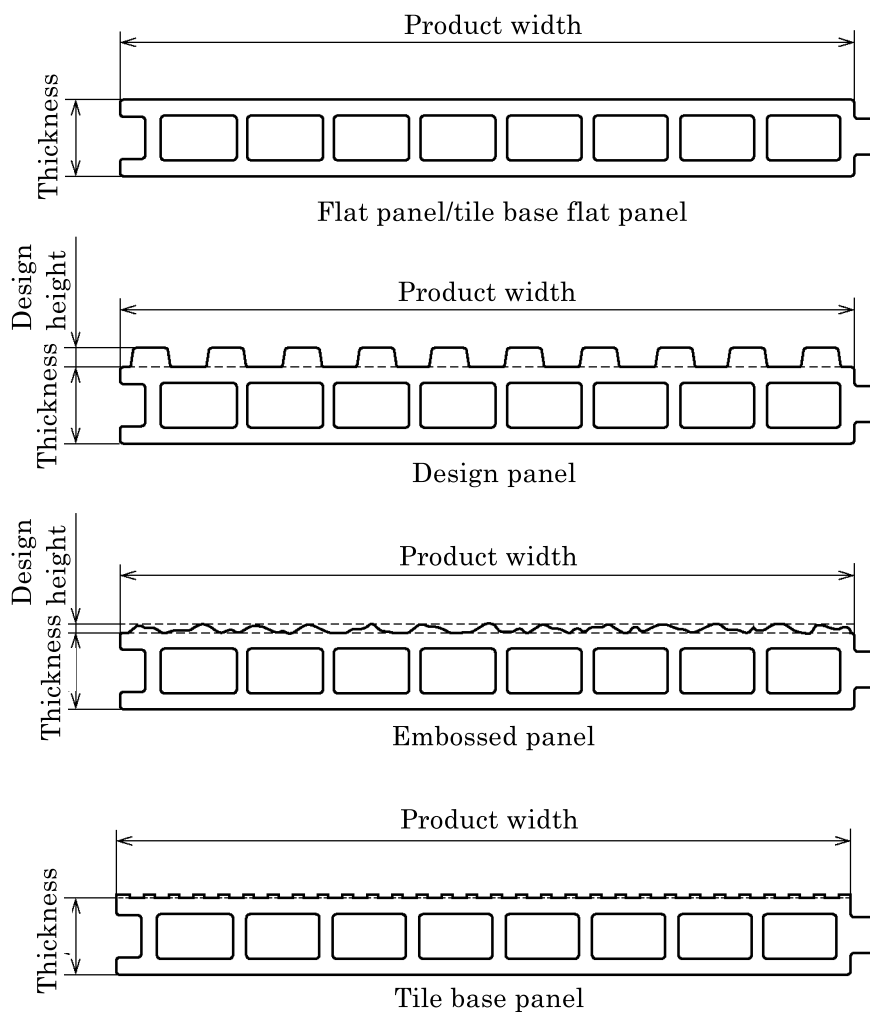
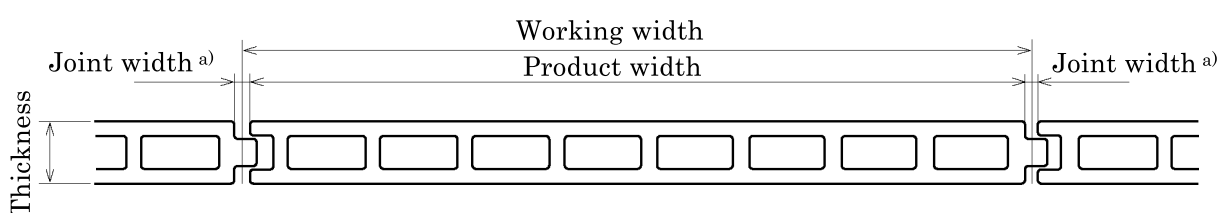


Figure 1 Examples of shape



Note a) The standard joint width is 10 mm when the product width is 900 mm or less, and 15 mm when the product width is over 900 mm.

Figure 2 Example of product width and thickness



Figure 3 Examples of dovetail groove configuration on tile base panel surface

The dimensions and dimensional tolerances of ECP shall be as follows.

Table 2 Dimensions of standard products

				Unit: mm
Classification of panel	Thickness	Product width	Working width	Length
Flat panel	35	440	450	5 000 max.
	50	490	500	
		590	600	
	60	440	450	
	75	490	500	
		590	600	
		890	900	
		985	1 000	
		1 185	1 200	
	100	440	450	
		490	500	
		590	600	
Design panel	50	590	600	
Embossed panel	60	890	900	
	75			
Tile base flat panel ^{b)}	60	1 195 max. ^{a)}	1 210 max.	
	75			
Tile base panel ^{c)}	60	895 max. ^{a)}	910 max.	
	75			
Note ^{a)} The product width of tile base flat panel and tile base panel shall fit the layout of tile. Note ^{b)} A tile base flat panel is a panel for tile adhesive facing and does not have dovetail grooves. Note ^{c)} The dovetail groove configuration on tile base panel surface is illustrated in Figure 3.				

Table 3 Dimensional tolerances

			Unit: mm
Classification of panel	Length	Product width	Thickness
Flat panel	0	0	+1.5
Tile base flat panel	-2	-2	-1.5
Tile base panel			
Design panel	0	+2	+1.5
Embossed panel	-2	-2	-1.5

- b) **Custom-made products** The length and product width of custom-made products shall be as agreed between the parties concerned with delivery, and their tolerance

es shall be in accordance with Table 3.

6 Quality

6.1 Performance

The performance shall be tested according to Clause 7, and conform to the requirements in Table 4.

Table 4 Performance

Material density	Water absorption	Flexural strength	Impact resistance	Rate of length change due to water absorption	Freezing and thawing resistance	Incombustibility or heat generation property ^{a)}
g/cm ³	%	N/mm ²		%		
1.7 min.	18 max.	17.6 min.	No fissures or penetrating cracks shall be observed.	0.07 max.	No noticeable fissures, blisters or peeling shall be observed, and the mass change rate shall not exceed 5 %.	Incombustibility class 1 or heat generation property class 1
Note ^{a)} Selection between the two properties is left to the agreement between the parties concerned with delivery.						

6.2 Appearance

The appearance of ECP, when visually examined, shall conform to the requirements in Table 5.

Table 5 Appearance

Type of defect	Criterion
Contamination, flaws	None that are remarkably conspicuous shall be observed.
Warpage, torsion	None that may be detrimental to use shall be observed.
Chips, inclusion of foreign matter	None that may be detrimental to use shall be observed.
Fissures, penetrating cracks	None shall be observed.

7 Tests

7.1 General conditions of test

The atmosphere of the laboratory shall be kept at the ordinary temperature and or-

dinary humidity.

7.2 Specimen

- a) **Size and number of specimens** The size and number of specimens shall be in accordance with Table 6.

Table 6 Size and number of specimens

Test item	Size of specimen (length × width) mm	Number of specimens
Material density	160 × 35	3
Water absorption	160 × 35	3
Flexural strength	1 200 × 450 min.	3
Impact resistance	1 800 × 1 790 min. ^{a)}	1
Rate of length change due to water absorption	160 × 40	2
Freezing and thawing resistance	200 × 100	3
Incombustibility or heat generation property	Incombustibility test 220 × 220	3
	Heat generation property test 99 × 99	3
Note ^{a)} A specimen shall consist of three panels of product width 590 mm or greater combined.		

- b) **Conditioning of specimen** Prior to test, the specimens shall be conditioned to air dried condition ¹⁾, or in the case of the specimens for incombustibility or heat generation property test, conditioned at a temperature of 23 °C ± 2 °C and a relative humidity of (50 ± 5) % until constant mass is attained.

Note ¹⁾ A specimen condition where the specimen has been left in a well-ventilated room for 14 days after preparation.

7.3 Measurement of dimensions

- a) **Number of sheets to be measured** Three sheets or more shall be measured for each classification of product.
- b) **Measuring procedure**

- 1) **Measurement of thickness** Measure the thickness at positions of minimum thickness near the four corners of the specimen that are at least 20 mm inside the periphery using the vernier callipers specified in **JIS B 7507**. Obtain the mean value of the four measurements and round it off to one decimal place.

For embossed panels, measure the distance from the back surface of the panel to the highest point of the embossed surface at four points using the vernier callipers specified in **JIS B 7507**, and subtract the design height from each of these measurements to take the results as the product thickness. Calculate the mean of the four product thickness values and round it off to one decimal place.

- 2) **Length and width measurement** Place the specimen on a flat surface and measure the length/width at one position at approximate centre of the specimen by using a Grade 1 convex rule graduated in 1 mm increments specified in **JIS B 7512** or a Grade 1 metal rule graduated in 1 mm increments specified in **JIS B 7516**.

7.4 Material density and water absorption

Take specimens of dimensions specified in Table 6 from the position shown in Figure 4. Immerse the specimens in water at the ordinary temperature, and after an elapse of 48 h, weigh the mass (W_1) of the specimens as they are suspended in water with a fine yarn or the like. Take out the specimens from the water, and after wiping each surface of the specimens, immediately weigh their mass (W_2). Then, dry the specimens for 48 h in a drying chamber with stirring function adjusted at $105\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$, and place them in a desiccator containing silica gel. When the specimens have cooled to the ordinary temperature, weigh their mass (W_0). For each measurement, mass shall be weighed to the precision of 0.1 g.

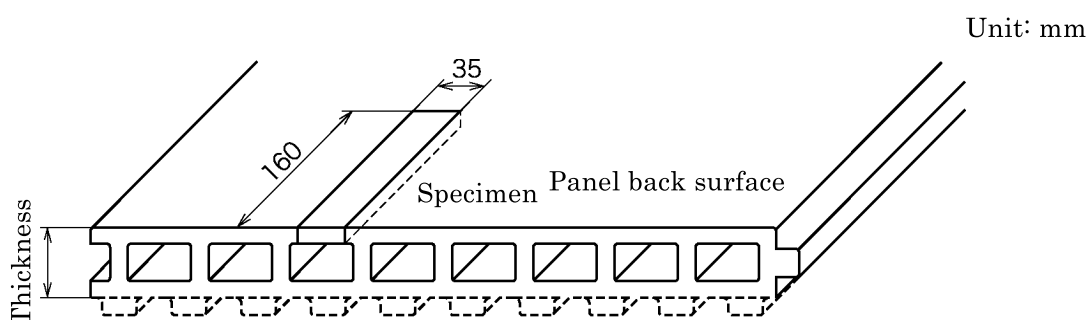


Figure 4 Specimen for material density and water absorption test

- a) **Water absorption** The water absorption shall be calculated according to Formula (1) and the result shall be rounded off to an integer:

$$Q = \frac{(W_2 - W_0)}{W_0} \times 100 \quad \dots\dots\dots (1)$$

where, Q : water absorption (%)
 W_0 : mass when dried (g)
 W_2 : mass after water absorption (g)

- b) **Material density** The material density shall be calculated according to Formulae (2) and (3), and the result shall be rounded off to one decimal place. The water density value used shall be as given in Table 7 according to the water temperature.

$$\rho = \frac{W_0}{V} \quad \dots\dots\dots (2)$$

$$V = \frac{W_2 - W_1}{\rho_w} \quad \dots\dots\dots (3)$$

where, ρ : material density (g/cm^3)

V : volume of specimen (cm³)
 W_0 : mass when dried (g)
 W_1 : mass when suspended in water (g)
 W_2 : mass after water absorption (g)
 ρ_w : density of water (g/cm³)

Table 7 Water density

Unit: g/cm³

Water temperature (°C)	0	1	2	3	4	5	6	7	8	9
0	—	—	—	—	—	1.000 0	0.999 9	0.999 9	0.999 9	0.999 8
10	0.999 7	0.999 6	0.999 5	0.999 4	0.999 2	0.999 1	0.998 9	0.998 8	0.998 6	0.998 4
20	0.998 2	0.998 0	0.997 8	0.997 5	0.997 3	0.997 0	0.996 8	0.996 5	0.996 2	0.995 9
30	0.995 7	0.995 3	0.995 0	0.994 7	0.994 4	0.994 0	—	—	—	—

7.5 Flexural strength

7.5.1 Specimen

The specimens used for flexural strength test shall have the width and thickness of the product. For design or embossed panels, the specimens may be flat panels of the same thickness and width, and from the same manufacturing lot as the panel being tested. The specimen length shall be greater than the supporting span length by 200 mm.

7.5.2 Test method

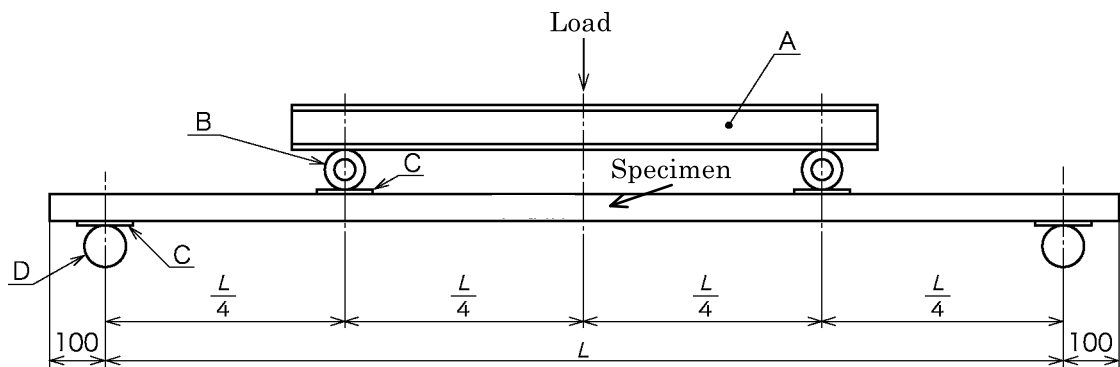
- For application of load, use a test apparatus that can perform 2-line loading on quarter-section point as shown in Figure 5. Place the specimen on the test apparatus with its front face up so that the load can be applied normal to the surface of the specimen. The supporting span length shall be 1 000 mm or greater.
- Perform loading such that the average rate of displacement at the centre of the span is approximately 5×10^{-2} mm/s or under, and obtain the flexural breaking load.
- Calculate the flexural strength according to Formula (4), and round the result off to one decimal place. The section modulus value used for the calculation shall be the design section modulus value.

$$F_b = \frac{PL}{8Z} + \frac{wL^2}{8Z} \dots\dots\dots (4)$$

where, F_b : flexural strength (N/mm²)
 P : flexural breaking load (N)
 L : supporting span length (mm)
 Z : section modulus (mm³)

w : weight of specimen per unit length (N/mm)

Unit: mm



Key

A : load application beam

B : bending roller (steel cylinder having a length equal to or greater than the width of the specimen, and such rigidity that its deformation under load will be negligible)

C : pressurizing plate (having a 100 mm width, a length equal to or greater than the width of the specimen and a thickness of 6 mm to 15 mm). Rubber strips or the like may be placed as packing between the pressurizing plates and the specimen surface at the load application points.

D : supporting roller (steel cylinder having a length equal to or greater than the width of the specimen, and such rigidity that its deformation under load will be negligible)

One end of the supporting rollers may be a pin and the other end a roller.

To prevent torsional deformation of the specimen, one of the supporting rollers may be positioned at the centre of the width direction.

L : supporting span length

Figure 5 Flexural strength test apparatus

7.6 Impact resistance

The impact resistance test shall be performed in accordance with 5.6 of JIS A 1414-2. Mount a specimen, which is a set of three panels 1 800 mm in length and at least 590 mm in product width, on a steel frame in accordance with the standard construction method of ECP. Joints between panels shall be filled with sealant for sealing and glazing in buildings conforming to Class 20LM of Type F or Class 25LM of Type F specified in JIS A 5758.

As shown in Figure 6, drop a sand bag of 30 kg in mass once from a height specified in Table 8 once onto the centre of the panel and then visually examine the panel for fissures on the front and back surfaces and penetrating cracks.

Table 8 Drop height according to ECP thickness

ECP thickness	Drop height
60 mm or over	2 m
50 mm or over to and excl. 60 mm	1.5 m
35 mm or over to and excl. 50 mm	1 m

Unit: mm

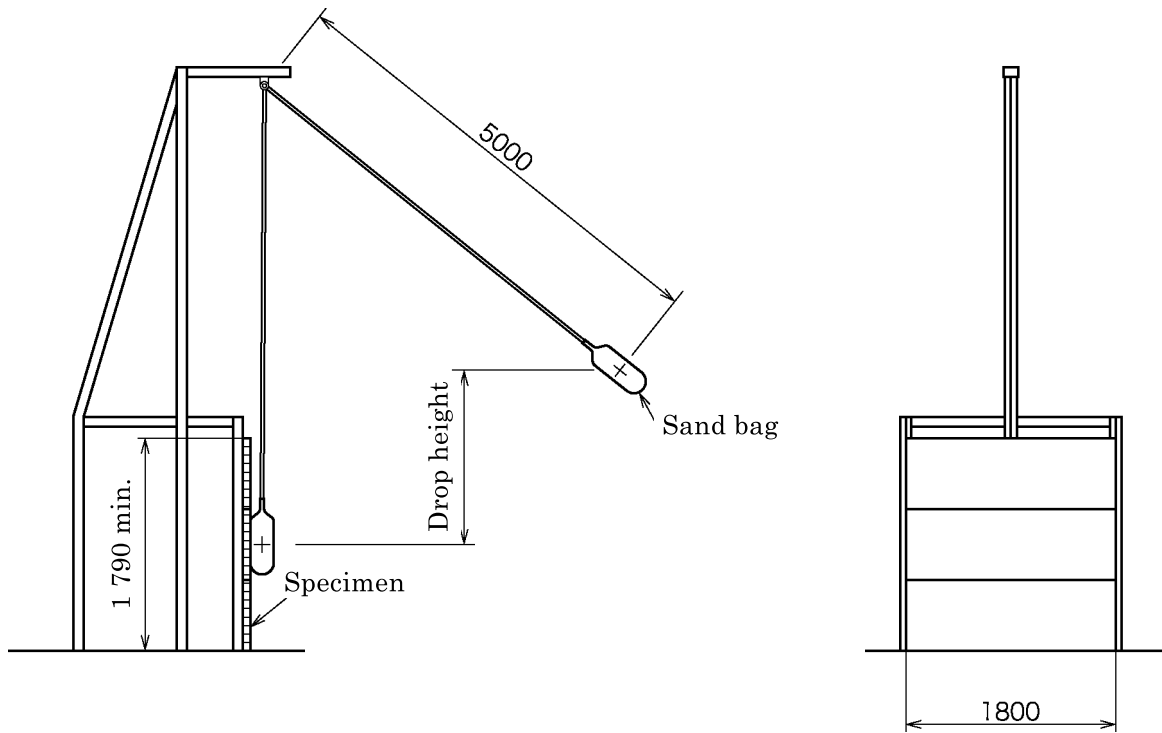


Figure 6 Impact test

7.7 Rate of length change due to water absorption

The measurement of the rate of length change due to water absorption shall be as follows.

- Take specimens of dimensions specified in Table 6 from the positions shown in Figure 7, put them in a drying chamber with stirring function, and after leaving them for a duration of 24 h while maintaining the temperature at $60\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$, remove them from the drying chamber, and leave them to stand in a desiccator containing calcium chloride or silica gel until they cool to the ordinary temperature.
- Scribe two gauge marks at a spacing of about 140 mm on the specimens as shown in Figure 8. Measure the length between the gauge marks by using a comparator with the precision of 1/500 mm or better and take it as the reference length (L_1).
- Set and hold the specimens under water at ordinary temperature such that their longitudinal direction is horizontal, and their upper end is about 3 cm below the