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**Precast unreinforced concrete
products**

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Foreword

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

Consequently **JIS A 5371:2004** is replaced with this Standard.

However, **JIS A 5371:2004** may be applied in the **JIS** mark certification based on the relevant provisions of Article 19 Clause 1, etc. of the Industrial Standardization Law until 22nd September, 2010.

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

Precast unreinforced concrete products

1 Scope

This Japanese Industrial Standard specifies the precast unreinforced concrete products (hereafter referred to as “URC products”). However, this Standard shall not be applied to individual concrete products for buildings and the tactile ground surface indicators for blind persons which are specified in separate Japanese Industrial Standards.

This Standard also applies to URC products which use the reinforcing steel, etc. for the purpose of securing safety in construction without intending to use the reinforced concrete structure.

The comparison table between previous and current editions of this Standard on technically significant revisions is listed in Annex E.

2 Normative references

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

JIS A 0203 *Concrete terminology*

JIS A 1107 *Method of sampling and testing for compressive strength of drilled cores of concrete*

JIS A 1108 *Method of test for compressive strength of concrete*

JIS A 1132 *Method of making and curing concrete specimens*

JIS A 5361 *Precast concrete products—General rules for classification, designation and marking*

JIS A 5362 *Precast concrete products—Required performance and methods of verification*

JIS A 5363 *Precast concrete products—General rules for methods of performance test*

JIS A 5364 *Precast concrete products—General rules of materials and product methods*

JIS A 5365 *Precast concrete products—General rules for method of inspection*

JIS B 7721 *Tension/compression testing machines—Verification and calibration of the force-measuring system*

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in **JIS A 0203** and the following terms and definitions apply.

3.1 Group I

URC products whose conformity with the stated performance is confirmed by actual results, which are manufactured based on such specification, and whose recommended specifications are indicated in Annexes

3.2 Group II

URC products whose performance and specifications are defined by the agreement between the parties concerned with delivery and which are manufactured based on such specifications

4 Classification

URC products shall be classified as specified in table 1 by the application.

In addition, products shall be classified into Group I and Group II according to the determination method of performance and specifications.

Table 1 Classification of URC products

Classification	Applicable clause in Annex
Covered conduits	See A.2.
Pavement/boundary blocks	See B.2.
Surface drainage ditches	See C.2.
Block type retaining walls	See D.2.
Other products Example 1 Drainage canals Example 2 Slope covering blocks Example 3 Sowed concrete blocks	Shall be subjected to the agreement between the parties concerned with delivery.
NOTE : Annexes include Group I having the recommended specifications and Group II having no recommended specifications.	

5 Quality

5.1 Appearance

The appearance shall be tested as specified in **8.1** and it shall be free from any flaw, crack, chip, camber, torsion (in the case of a board-like product), etc. which are detrimental practically. Moreover, the water-contact surface of URC products for water-channel shall be as smooth as practically acceptable.

5.2 Performance

The performance shall conform to the provisions of table 2 when tested as specified in clause **8**.

Table 2 Performance of URC products

Classification	Applicable clause in Annex
Covered conduits	See A.3.
Pavement/boundary blocks	See B.3.
Surface drainage ditches	See C.3.
Block type retaining walls	See D.3.
Other products Example 1 Drainage canals Example 2 Slope covering blocks Example 3 Sowed concrete blocks	a) Performance Specific items of performance shall be selected and designated subjected to the agreement between the parties concerned with delivery as specified in JIS A 5362. When performance is clearly correlated with product specifications (dimensions, materials, etc.), the agreement may be substituted by designation of product specifications indicated in b). b) Specification of alternative characteristics The specification of alternative characteristics shall be as follows. 1) Dimensions 2) Compressive strength of concrete

6 Shape, dimensions and dimensional tolerances

The shape, dimensions and dimensional tolerances shall be as specified in table 3.

Table 3 Shape, dimensions and dimensional tolerances of URC products

Classification	Applicable clause in Annex
Covered conduits	See A.4.
Pavement/boundary blocks	See B.4.
Surface drainage ditches	See C.4.
Block type retaining walls	See D.4.
Other products Example 1 Drainage canals Example 2 Slope covering blocks Example 3 Sowed concrete blocks	Shall be subjected to the agreement between the parties concerned with delivery.

7 Material and production method

The material used for URC products and the production method shall be as specified in **JIS A 5364**.

8 Test methods

8.1 Appearance test

The appearance test shall be conducted by a visual observation to check for any flaw, crack, chip, camber, torsion (in the case of a board-like product), etc. which are detrimental practically.

8.2 Performance test

The test method of performance shall be as specified in **JIS A 5363** and table 4.

Table 4 Performance test method of URC products

Classification	Applicable clause in Annex
Covered conduits	See A.5 .
Pavement/boundary blocks	See B.5 .
Surface drainage ditches	See C.5 .
Block type retaining walls	See D.5 .
Other products Example 1 Drainage canals Example 2 Slope covering blocks Example 3 Sowed concrete blocks	Shall be subjected to the agreement between the parties concerned with delivery.

9 Inspections

9.1 Inspection items

The inspection items of the final inspection conducted by the manufacturer and the delivery inspection conducted for confirmation at the time of acceptance shall be as follows.

- a) **Final inspection items** The final inspection items shall be as follows.
- 1) Appearance
 - 2) Performance
 - 3) Shape and dimensions
- b) **Delivery inspection items** The delivery inspection items shall be as follows. However, the delivery inspection may be omitted subjected to the agreement between the parties concerned with delivery.
- 1) Appearance
 - 2) Shape and dimensions

9.2 Inspection method

The inspection method shall be as specified in **JIS A 5365** and table 5.

Table 5 Inspection method of URC products

Classification	Applicable clause in Annex
Covered conduits	See A.7.
Pavement/boundary blocks	See B.7.
Surface drainage ditches	See C.7.
Block type retaining walls	See D.7.
Other products Example 1 Drainage canals Example 2 Slope covering blocks Example 3 Sowed concrete blocks	Shall be subjected to the agreement between the parties concerned with delivery.

10 Designation of products

The designation of products shall be as specified in **JIS A 5361**.

11 Marking

For URC products, items specified in **JIS A 5361** shall be marked. If the marking is particularly specified in Annex of this Standard, Annex shall prevail. For the Group II products, the following items shall be marked on products.

- Characters “Group II”
- Classification (nominal designation determined by the manufacturer), or its abbreviation
- Other necessary item, or its abbreviation

12 Report

The manufacturer shall present the report about the appearance, performance, shape, dimensions, etc., when requested by the purchaser.

Annex A (normative)

Covered conduits

A.1 Outline

This Annex specifies Group I and Group II of covered conduits which are used mainly for the sewerage and the irrigation drainage among the URC products specified in this Standard.

A.2 Classification

The classification of covered conduits shall be as specified in table A.1.

In addition, Group I shall be as specified in table A.2.

Table A.1 Classification of covered conduits

Major division	Minor division
Covered conduits	Unreinforced concrete pipe
	Others

Table A.2 Classification of covered conduits Group I

Classification	Division by application	Detail
Unreinforced concrete pipes	Products which are used for a water-channel, where large load is not applied	See recommended specification A-1.

A.3 Performance

The performance of covered conduits shall conform to the provisions of table A.3.

In addition, the performance items of Group II shall be subjected to the agreement between the parties concerned with delivery.

Table A.3 Performance of covered conduits

Performance item	Performance	Performance check method
Service stage performance	Shall be safe to the regular load assumed at the time of use, and shall not produce the crack.	See design document or A.5 .
Durability ^{a)}	Durability shall be secured against deterioration assumed.	Refer to design document or actual results.
Workability	Workability for transportation, installation, assembly, etc. shall be secured.	Refer to design document or actual results.
Note ^{a)} Durability may be confirmed by the actual results of such similar products as are equivalent in terms of water-cement ratio and/or air content.		

A.4 Shape, dimensions and dimensional tolerances

The shape, dimensions and dimensional tolerances of covered conduits shall be as follows. As to Group I, if the design concept is not different, and if the performance (quality) and performance (quality) check method are the same, the reference dimension may be changed within $\pm 10\%$ in response to the purchaser's demand, provided that the necessary performance (quality) is satisfied.

a) **Shape** The shape of unreinforced concrete pipe is shown in figure A.1.

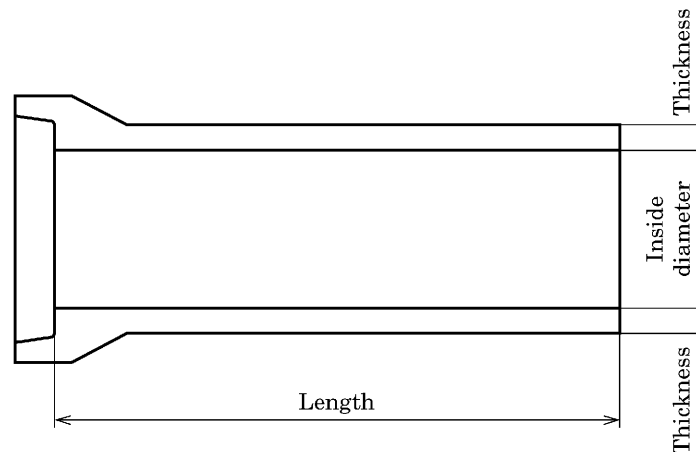


Figure A.1 Example of shape of unreinforced concrete pipe

b) **Dimensions and dimensional tolerances** The dimensions and dimensional tolerances of the products classified into Group I shall be as specified in table A.4. The dimensions and dimensional tolerances of the products classified into Group II shall be subjected to the agreement between the parties concerned with delivery.

Table A.4 Dimensions and dimensional tolerances of unreinforced concrete pipes

Unit: mm				
Classification		Inside diameter	Thickness	Length
Unreinforced concrete pipe	Dimensions	100 to 600	24 to 58	1 000
	Tolerances	± 4 to ± 7	$\begin{matrix} +3 \\ -2 \end{matrix}$ to $\begin{matrix} +5 \\ -3 \end{matrix}$	$\begin{matrix} +10 \\ -5 \end{matrix}$
NOTE 1 The length shown here is that of standard products. The length may be shorter than this.				
NOTE 2 For details of tolerances, see recommended specification A-1.				

A.5 Test method

A.5.1 Compressive strength test

The compressive strength test shall be as specified in **JIS A 1132** and **JIS A 1108**.

A.5.2 Flexural strength test

The flexural strength test shall be as specified in **JIS A 5363**.

The tester shall be of Class 1 or superior specified in **JIS B 7721**, or shall be at least equivalent in allowance thereto.

A.6 Quality of concrete

A.6.1 Material and production method

The material for concrete and the production method shall be as specified in **JIS A 5364**.

A.6.2 Compressive strength

For the unreinforced concrete pipe, the compressive strength shall satisfy the flexural strength of products.

In addition, products of Group II shall be subjected to the agreement between the parties concerned with delivery.

A.7 Inspections

Inspections shall be as specified in **JIS A 5365** and the following.

- a) **Final inspection** The final inspection of covered conduits shall be conducted for the appearance, performance, shape and dimensions, and shall be as follows.
 - 1) **Appearance** For the appearance, it shall be a 100 % inspection or a sampling inspection in consideration of the characteristics of the product, production method, production quantity, etc.
 - 2) **Performance, shape and dimensions** For the performance, shape and dimensions, the inspection shall be a sampling inspection.

When the performance is inspected by a sample as alternative characteristics, the correlation between the sample and the product shall be established.
 - 3) **Size of inspection lot** The size of inspection lot shall be determined by the manufacturer in consideration of the characteristics of product, production method, production quantity, production period, ordered quantity, etc.

Any product in the inspection lot shall have the same characteristics, and shall be manufactured using the same materials, concrete mix proportion and production method.
- b) **Delivery inspection** The delivery inspection of covered conduits shall be conducted for the appearance, shape and dimensions. The size of inspection lot and the sampling method shall be subjected to the agreement between the parties concerned with delivery, and shall be specified by the purchaser. The delivery inspection may be omitted subjected to the agreement between the parties concerned with delivery.

A.8 Marking

The marking on covered conduits shall indicate the following items as specified in **JIS A 5361**.

- a) Classification or its abbreviation
- b) Manufacturer's name or its abbreviation
- c) Date of manufacture or its abbreviation
- d) When recycle material is used, the statement to that effect

A.9 Others (recommended specification)

Group I of covered conduits is shown in table A.5.

Table A.5 Recommended specification

Structure-specific product group standard		Recommended specification
JIS A 5371	Annex A (normative) Covered conduits	Recommended specification A-1 Unreinforced concrete pipes

Recommended specification A-1 Unreinforced concrete pipes

A-1.1 Outline

This recommended specification describes the unreinforced concrete pipes of covered conduits Group I (hereafter referred to as “pipes”) in Annex A.

A-1.2 Classification

The pipes shall be classified by the inside diameter as specified in recommended specification A-1 table 1.

Recommended specification A-1 table 1
Classification and flexural strength load of pipes

Unit: kN/m

Classification	Flexural strength load
100	30
150	25
200	22
250	20
300	
350	22
400	24
450	27
500	30
600	36

A-1.3 Performance (flexural strength)

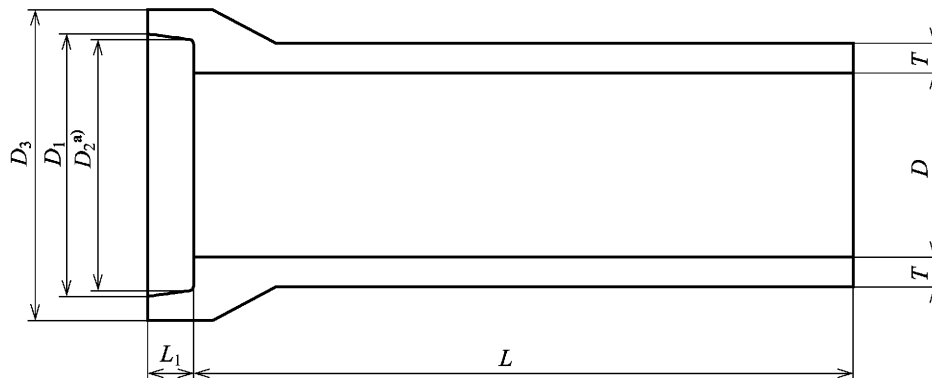
The pipes shall be subjected to the flexural strength test as specified in **A-1.5**. When pipes receive the flexural strength load specified in recommended specification A-1 table 1, they shall not produce the crack.

A-1.4 Shape, dimensions and dimensional tolerances

The shape, dimensions and dimensional tolerances of pipes shall be as specified in recommended specification A-1 table 2.

If the reference dimension is changed within the range as specified in **A.4**, the manufacturer shall present the data indicating that pipes conform to **A.3** by the design document or performance test when requested by the purchaser.

Recommended specification A-1 table 2
Shape, dimensions and dimensional tolerances of pipe



Unit: mm

Classification	Inside diameter		Thickness		Effective length		Socket segment					
	D	Tolerances	T	Tolerances	L	Tolerances	Inside diameter		Outside diameter		Depth	
							D_1	Tolerances ^{b)}	D_3	Tolerances	L_1	Tolerances
100	100	± 4	24	$+3$ -2	1 000	$+10$ -5	170	-4	218	$+10$ -5	60	$+10$ -5
150	150		26				228		280		70	
200	200	± 5	29				286	-5	344		$+10$ -5	
250	250		32	344			408					
300	300	± 6	35	$+4$ -3			402	-6	472			
350	350		38				460		536			
400	400	± 7	42				520	-7	604			
450	450		46	580			672					
500	500		50	640			740					
600	600		58	756			872					

The inside and outside circumferences of the cross section of pipes shall be practically a concentric circle. The end face shall be practically right-angled to the pipe axis.

NOTE : Chamfer, notch and other processing are allowed, if they do not affect the shape and they do not compromise the strength.

Notes ^{a)} $D_1 > D_2 > D + 2T$

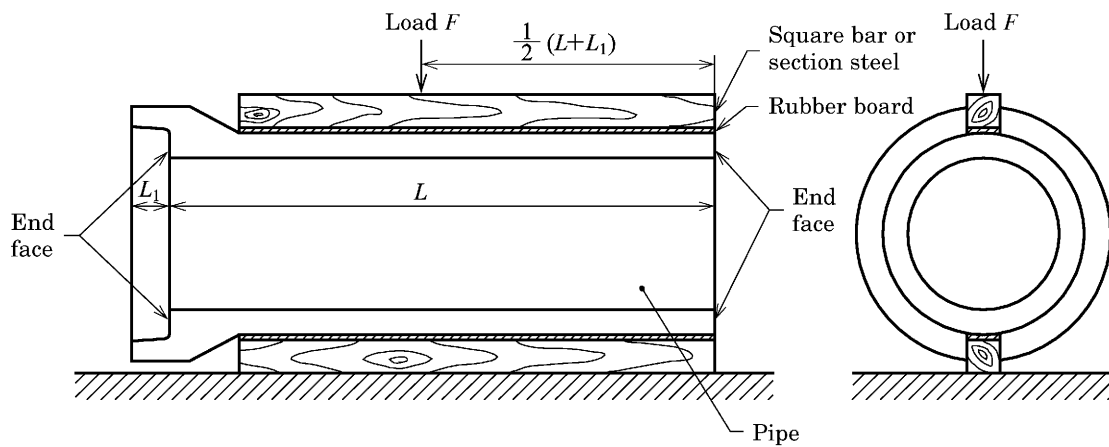
^{b)} The plus side value of tolerance of inside diameter D_1 is not specified.

A-1.5 Flexural strength test

For the flexural strength test, pipes shall be installed as shown in recommended specification A-1 figure 1. At the flexural strength load specified in recommended specification A-1 table 1, the existence of cracks shall be examined.

When a flexural strength test is conducted, the rubber board of about 20 mm in thickness and the square bar or the section steel of about 150 mm × 150 mm shall be applied to the top and bottom of a pipe. The test shall be conducted by vertically applying a load to ensure uniform distribution of load to the pipe body.

The tester shall be of Class 1 or superior specified in **JIS B 7721**, or shall be at least equivalent in allowance thereto.



Recommended specification A-1 figure 1
Flexural strength test method of pipe

A-1.6 Quality of concrete

The compressive strength of concrete shall be as specified in **A.6.2**.

A-1.7 Inspections

A-1.7.1 Inspection items

The inspection items of pipes shall be as follows.

- a) **Final inspection** The final inspection items shall be as follows.
 - 1) Appearance
 - 2) Performance
 - 3) Shape and dimensions
- b) **Delivery inspection** The delivery inspection items shall be as follows. However, the delivery inspection may be omitted subjected to the agreement between the parties concerned with delivery.
 - 1) Appearance
 - 2) Shape and dimensions

A-1.7.2 Inspection lot

The size of inspection lot of pipes shall be decided by the manufacturer for final inspection, and by the purchaser for delivery inspection subjected to the agreement between the parties concerned with delivery by considering characteristics of the product, production method, production quantity, production period, ordered quantity, etc. One inspection lot may consist of 300 units or fraction thereof.

A-1.7.3 Inspection method

The inspection method of pipes shall be as follows.

a) **Final inspection** The final inspection method shall be as follows.

- 1) **Appearance** The inspection of appearance shall be conducted by taking arbitrary number of samples per one lot. When they conform to the provisions of **5.1**, the lot shall be accepted. If one or more of them do not conform, the lot shall be inspected 100 %, and accepted when the provisions are conformed.
- 2) **Performance** For the inspection of performance, two arbitrary samples per one lot shall be taken and inspected as specified in **A-1.5**. If both of the two conform to **A-1.3**, the lot shall be accepted. If neither of the two conforms, the lot shall be rejected. In this inspection, if one of the two does not conform to the provisions, four more samples shall be taken from the lot. If all the four conform to the provisions, the lot shall be accepted after the first non-conforming product is eliminated. If one or more of them do not conform, the lot shall be rejected.
- 3) **Shape and dimensions** For the inspection of shape and dimensions, two arbitrary samples per one lot shall be taken. If both of the two conform to the provisions of **A-1.4**, the lot shall be accepted. If one or more of them do not conform, the lot shall be inspected 100 %, and accepted when the provisions are conformed.

b) **Delivery inspection** The delivery inspection method shall be as follows.

- 1) **Appearance** The appearance shall be inspected in the same way as a).
When adopting the sampling inspection, if two arbitrary samples per one lot are inspected and conformed to the provisions of **5.1**, the lot shall be accepted. If only one of the two does not conform, the lot shall be inspected 100 %, and accepted when the provisions are conformed.
- 2) **Shape and dimensions** The shape and dimensions shall be inspected in the same way as a).

A-1.8 Marking

The pipes which conform to all the requirements of this Standard shall be marked as specified in **A.8**.

Annex B (normative)

Pavement/boundary blocks

B.1 Outline

This Annex specifies Group I and Group II of pavement/boundary blocks which are used mainly for the pavement and boundary of the road, etc. among the URC products specified in this Standard.

B.2 Classification

The classification of pavement/boundary blocks shall be as specified in table B.1. In addition, Group I shall be as specified in table B.2.

Table B.1 Classification of pavement/boundary blocks

Major division	Minor division
Pavement/boundary blocks	Flat plate
	Boundary block
	Interlocking block
	Others

Table B.2 Classification of pavement/boundary blocks, Group I

Classification	Division by performance or application	Detail
Flat plates	Normal flat plate	See recommended specification B-1.
	Water permeable flat plate	
	Water retentive flat plate	
Boundary blocks	Single sidewalk/roadway boundary block	See recommended specification B-2.
	Double sidewalk/roadway boundary block	
	Site frontage boundary block	
Interlocking blocks	Normal block	See recommended specification B-3.
	Water permeable block	
	Water retentive block	

B.3 Performance

The performance of pavement/boundary blocks shall conform to the provisions of table B.3.

In addition, the performance items of Group II shall be subjected to the agreement between the parties concerned with delivery.

Table B.3 Performance of pavement/boundary blocks

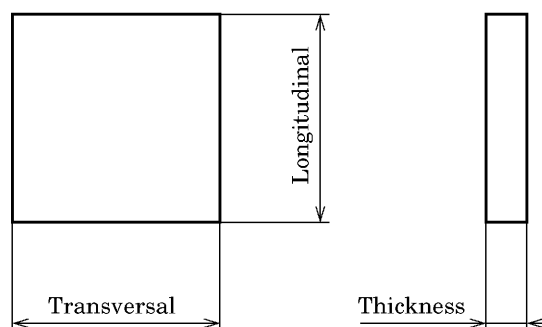
Performance item	Performance	Performance check method
Service stage performance	Shall be safe to the regular load assumed at the time of use, and shall not produce the crack.	See design document or B.5 .
Durability ^{a)}	Durability shall be secured against deterioration assumed.	See design document or actual results.
Workability	Workability for transportation, installation, assembly, etc. shall be secured.	See design document or actual results.
Others ^{b)}	Water permeability or water retention capability shall be secured.	See design document or B.5 .
Notes ^{a)} Durability may be confirmed by the actual results of such similar products as are equivalent in terms of water-cement ratio and/or air content. However, the resistance to frost damage of the product having the water retention capability that is used in the location where frost damage may occur shall be confirmed by the achievements of the product of equivalent quality or the freezing and thawing test results. ^{b)} Confirmation of the water permeability shall apply to the flat plate (water permeable flat plate) and interlocking block (water permeable block). Confirmation of the water retention capability shall apply to flat plate (water retentive flat plate) and interlocking block (water retentive block).		

B.4 Shape, dimensions and dimensional tolerances

The shape, dimensions and dimensional tolerances of pavement/boundary blocks shall be as follows. As to Group I, if the design concept is not different, and if the performance (quality) and performance (quality) check method are the same, the reference dimension may be changed within $\pm 10\%$ in response to purchaser's demand, provided that the necessary performance (quality) is satisfied.

a) Shape

- 1) **Flat plate** The shape of flat plate is shown in figure B.1.

**Figure B.1 Example of shape of flat plate**

- 2) **Boundary block** The shape of boundary block is shown in figure B.2.

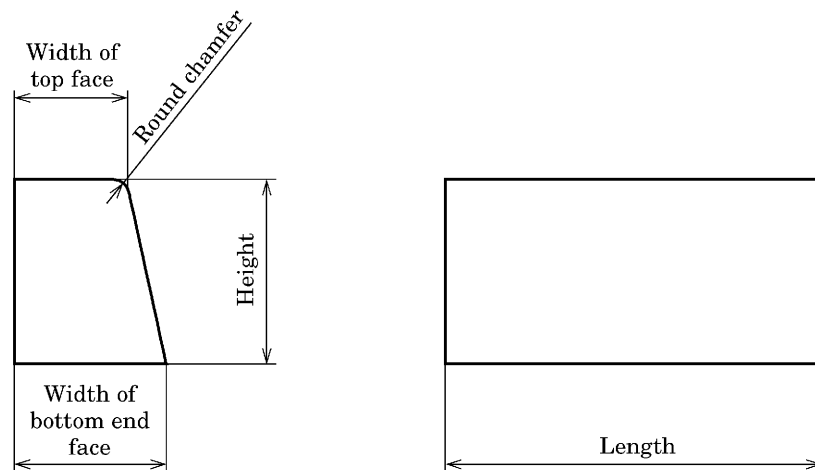


Figure B.2 Example of shape of boundary block

3) **Interlocking block** The shape of interlocking block is shown in figure B.3.

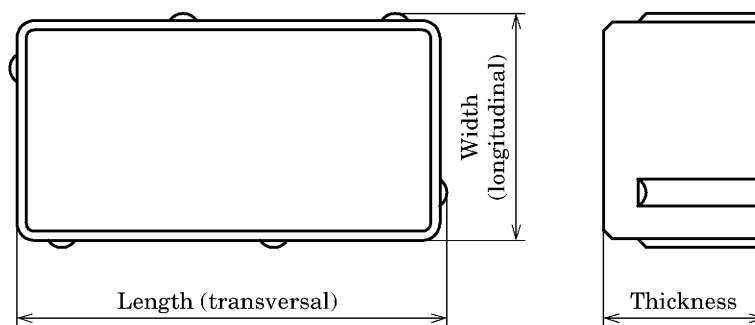


Figure B.3 Example of shape of interlocking block

b) **Dimensions and dimensional tolerances** The dimensions and dimensional tolerances of the products classified into Group I shall be specified in table B.4 to table B.6. The dimensions and dimensional tolerances of the products classified into Group II shall be subjected to the agreement between the parties concerned with delivery.

1) **Flat plate** The dimensions and dimensional tolerances of flat plates shall be as specified in table B.4.

Table B.4 Dimensions and dimensional tolerances of flat plates

Unit: mm

Classification		Longitudinal	Transversal	Thickness
Flat plate	Dimensions	300 to 500	300 to 500	30 to 80
	Tolerances	± 3	± 3	+2 -3
NOTE 1 Products may have coloration on exposed face and surface treatments (grinding, scrubbing, hammering and other processing), provided that they do not affect the performance.				
NOTE 2 The depth of surface pattern shall be within 6 mm and the surface may be chamfered.				

- 2) **Boundary block** The dimensions and dimensional tolerances of boundary blocks shall be as specified in table B.5.

Table B.5 Dimensions and dimensional tolerances of boundary blocks

Unit: mm

Classification		Top face width	Bottom face width	Height	Round chamfer	Length
Boundary block	Dimensions	120 to 180	120 to 240	120 to 300	20 to 30	600 to 2 000
	Tolerances	± 2	± 3	± 3	—	$\pm 3^a)$
NOTE 1 Products may have coloration on exposed face and surface treatments (grinding, scrubbing and other processing), provided that they do not affect the performance.						
NOTE 2 The length shown here is that of standard products. The length may be shorter than this.						
Note ^{a)} The length of sidewalk/roadway boundary blocks may be 1 000 mm or 2 000 mm. The tolerances in the case of 1 000 mm or 2 000 mm shall be ± 5 mm.						

- 3) **Interlocking block** The dimensions and dimensional tolerances of interlocking blocks shall be as specified in table B.6.

Table B.6 Dimensions and dimensional tolerances of interlocking blocks

Unit: mm

Classification		Width (longitudinal) ^{a)}	Length (transversal) ^{a)}	Thickness
Interlocking block	Dimensions	50 min. ^{a)}	50 min. ^{a)}	60 80 ^{b)}
	Tolerances	±2.5	±2.5	±2.5 ^{c)}
				+4.0 ^{d)} −1.0
NOTE 1 Products may have coloration on exposed face and surface treatments (grinding, scrubbing and other processing), provided that they do not affect the performance.				
NOTE 2 The block may be made to be a block intended for vegetation by providing a hole and/or a concave portion.				
Notes ^{a)} The width and length of a block shall be in the range satisfying the following formula. $\frac{\text{Block side face area}}{\text{Block top face area}} \geq 0.65$				
^{b)} The range of dimensions applies to the normal blocks, water permeable blocks and water retentive blocks.				
^{c)} The tolerances of thickness applies to the normal blocks.				
^{d)} The tolerances of thickness applies to the water permeable blocks and water retentive blocks.				

B.5 Test method

B.5.1 Compressive strength test

The compressive strength test shall be as specified in **JIS A 1108** and **JIS A 1132**, or **JIS A 1107**.

B.5.2 Flexural strength test

The flexural strength test shall be as specified in **JIS A 5363**.

The tester shall be of Class 1 or superior specified in **JIS B 7721**, or shall be at least equivalent in allowance thereto.

B.5.3 Water permeability test

The water permeability test shall be conducted as follows. The sample is fixed inside a formwork as specified in figure B.4, water is poured into the formwork placed in the tank specified in figure B.5 up until water overflows from the overflow hole located in upper side of the formwork, then water pouring is adjusted so as to keep the constant water level. The waterhead difference (the difference between the level of water in the formwork and the level of water in the tank) shall be measured, and the volume Q (cm³) of drained water for 30 s shall be measured by a graduated cylinder.

The water permeable coefficient shall be calculated according to the following formula.

$$k = \frac{t}{\Delta h} \times \frac{Q}{A \times 30}$$

where, k : water permeability coefficient (cm/s)

t : thickness of sample (cm)

Q : volume of drained water (cm³)

Δh : waterhead difference (cm)

A : area of sample (cm²)

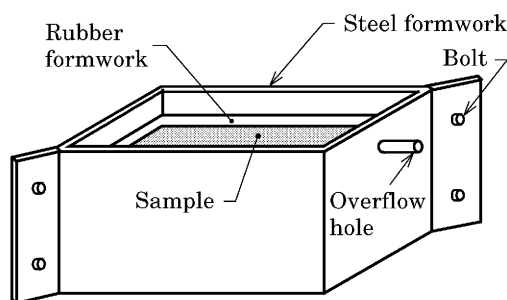


Figure B.4 Example of formwork used for permeability test

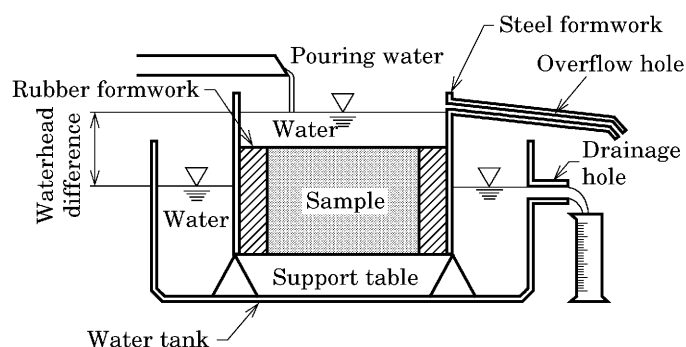


Figure B.5 Schematic view of equipment used for permeability test

B.5.4 Water retention test

B.5.4.1 Water retention test

The purpose of the water retention test shall be to obtain the amount of water retention. The sample used for the test shall be a block as it is. The amount of water retention shall be calculated according to the following formula by obtaining the wet mass and the absolute dry mass, and the volume of the sample. At this time, the volume shall be calculated from the product dimensions by multiplying the surface area by

thickness. The surface area may be obtained by the nominal dimensions. The numerical value of the amount of water retention shall be rounded to second decimal place.

$$w_r = \frac{m_w - m_d}{V}$$

where, w_r : amount of water retention (g/cm³)

m_w : wet mass (g)

mass obtained in such a way that after the sample is made to absorb water in fresh water of 15 °C to 25 °C for 24 h, the sample is taken out and put into an enclosed plastic container as shown in figure B.6 and dewatered in a room of 15 °C to 30 °C for 30 min, and after the visible water film is wiped with a wrung wet waste cloth, the mass of the sample is measured immediately

m_d : absolute dry mass (g)

mass obtained in such a way that after the sample is made dry until the mass becomes constant in the dry oven of a temperature of 105 °C ± 5 °C, the mass of the sample is measured when the sample is cooled to the ordinary temperature

V : volume of sample (cm³)

Unit: mm

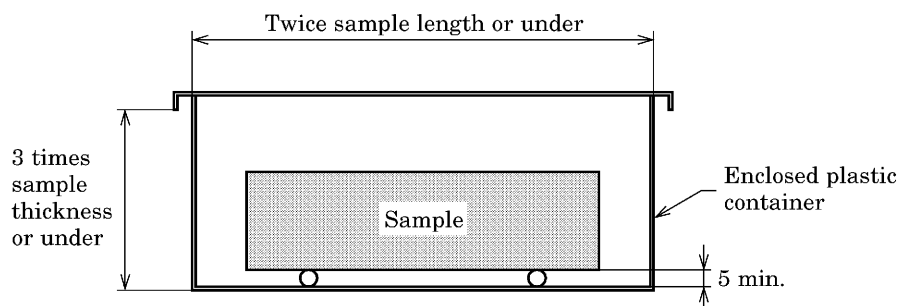


Figure B.6 Schematic view of equipment making wet

B.5.4.2 Water absorption test

The purpose of the water absorption test is to obtain the height of water absorbed in 30 min. The sample used for the test shall be a block as it is. After the block is made dry until the mass becomes constant in the dry oven of a temperature of 105 °C ± 5 °C, it shall be cooled to the ordinary temperature. The block shall be installed in the equipment used for the water absorption test shown in figure B.7. The water level at the time of installation shall be made to be 5 mm in height from the block bottom face, and water shall be a fresh water of 15 °C to 25 °C. The material such as a wire mesh in which water turns under the bottom face of the block shall be used as the top face of the sample installation stand. After a lapse of 30 min, the block shall be taken out and dewatered to such a degree that water does not drip and the visible water film shall be wiped with a wrung waste cloth. The mass at this time shall be taken as the