International Standard ISO 7729

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Typical vertical joints between two prefabricated ordinary concrete external wall components — Properties, characteristics and classification criteria

Assemblages verticaux courants entre deux composants de façade en béton ordinaire — Propriétés, caractéristiques et éléments de la classification

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

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Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Typical vertical joints between two prefabricated ordinary concrete external wall components — Properties, characteristics and classification criteria

0 Introduction

This International Standard describes for designers a convention for jointing two prefabricated ordinary concrete external wall components.

This convention refers, as often as possible, to standardized methods for the determination of the properties of the joint. However, methods have still not been elaborated for some of these properties, in particular for watertightness. Because of the fundamental importance of this property, solutions are proposed, by way of examples, that experience and laboratory studies have shown to be satisfactory under the usual conditions. These solutions are not the only possibilities, however.

1 Scope

This International Standard specifies the properties and characteristics of typical vertical joints between two prefabricated concrete external wall components irrespective of whether these joints coincide with joints between the external wall and an internal wall or column.[1)]

However, the characteristics of joints which are involved in the structural behaviour of buildings are not specified in this International Standard.

2 Field of application

This International Standard is applicable to all public or private buildings, used as dwellings, offices, educational or hospital premises.[2)]

3 References

ISO 140/4, *Acoustics — Measurement of sound insulation in buildings and of building elements — Part 4: Field measurements of airborne sound insulation between rooms.*

ISO 717/1, *Acoustics — Rating of sound insulation in buildings and of building elements — Part 1: Airborne sound insulation in buildings and of interior building elements.*

ISO 2444, *Joints in building — Vocabulary.*

ISO 2445, *Joints in building — Fundamental principles for design.*

ISO 3447, *Joints in building — General check-list of joint functions.*

ISO 6589, *Joints in building — Method of test for air-permeability of joints.*

ISO 7728, *Typical horizontal joints between an external wall of prefabricated ordinary concrete components and a concrete floor — Properties, characteristics and classification criteria.*

4 Definitions

For the purposes of this International Standard, the definitions given in ISO 2444, together with the following, apply.

watertightness system with tongue and grooves: Assembly made of two grooves and a tongue the shapes of which are such that the tongue may be inserted longitudinally into the grooves through a slot in these grooves but cannot move transversely out of the grooves without a significant effort.

1) The joints participate in the separation of the external and internal environments. They also participate in the separation of two internal spaces if these are separated by an internal wall and the joint of this with the external wall coincides with the vertical joint between the two external wall components.

2) The field of application can be extended to buildings for industrial use if the essential and optional character of some of the properties specified in clause 5 are modified.

5 Properties of joints and agents to which they are exposed

5.1 Properties

5.1.1 Necessary properties [1)]

a) To limit thermal losses (between the internal and external environments).

b) To limit sound transmission (between the spaces separated by the internal wall, if any).

c) To provide satisfactory resistance to air penetration.

d) To ensure water- and snowtightness between the exterior and interior.

e) To prevent the passage of light (between spaces separated by the internal wall, if any).

f) The joints should not emit odours (odours emitted by jointing products).

g) Condensation of water vapour should not occur opposite the joints and in the joints on the internal face of the wall.

h) To resist stresses in one or more directions due to the transmission of static or dynamic forces in the wall (forces inherent to the function, if any, of the external wall in the stability of the construction), by impacts and vibrations of various origins, by dimensional variations and deformations of materials, components and parts of the construction (shrinkage or expansion, creep, thermal dilation or contraction, etc.).

j) To prevent the passage of flames, smoke and gases, between the spaces separated by the internal wall, if any.

k) The joints should not generate gases and toxic fumes in the event of fire (for the part of the junctions in contact with or in the vicinity of the internal environment).

m) To be of and to maintain an acceptable appearance on both external and internal sides.

n) To have a service life of a specified minimum duration and, in particular, to withstand

— reasonably foreseeable damage caused by human beings;

— the action of animals (mammals, birds, insects, etc.);

— the action of plants and micro-organisms;

— the action of water, water vapour or aqueous solutions and suspensions;

— the action of air and wind;

— the action of various physico-chemical environmental agents (acids, alkalis, oils, greases, solvents, etc.);

— the action of dust;

— the action of light and radiation;

— the action of freezing;

— the action of variations of temperature and humidity;

— the action of extreme temperatures;

— the action of airborne or structure-borne vibrations;

— abrasive action (when the jointed components are affected by important variations of sizes allowed by the joint).

p) To allow maintenance of the jointing material, the durability of which depends upon that maintenance.

q) To allow replacement of degradable jointing materials.

r) To accommodate deviations in dimensions of the joint due to deviations in the dimensions and position of the jointed components.

5.1.2 Optional properties

a) To limit the thermal transmission between the spaces separated by the internal wall, if any (when one of these spaces does not belong to the heated environment, for example stairwell, shaft, corridors or vertical ducts).

b) To limit sound transmission between the external and internal environments (when there are requirements for acoustical insulation of the internal environment with regard to the external environment).

c) To prevent the ingress of animals, birds and insects, plants, dust, organic and inorganic particles (in general this function is fulfilled if the joint limits air penetration satisfactorily).

d) To avoid emission of sound or noise (in the case of joints in which an air column could become resonant when excited by the wind).

1) Some of the properties mentioned are effective only if, in the wall, the joints correspond really to the design. In particular it is essential that the edges of the components do not suffer any deterioration significantly modifying the geometry of the joints.

5.2 Agents to which joints are exposed

The joints are exposed to the following agents:

— forces from various origins (gravity, wind, vibrations, transmission of forces, etc.);

— variations of temperature and humidity of the internal and external environments between specified limits;

— noises from air and surface traffic and noises from neighbouring premises;

— rain, snow and ice;

— solar radiation;

— agents contained in external and internal environments;

— mammals, birds, insects and micro-organisms.

6 Characteristics of joints [1)]

The characteristics of joints affecting the necessary properties of joints are as follows.

6.1 Thermal transmission between internal and external environments

Methods of calculation and measurement of the corresponding losses will form the subject of a future International Standard. They are expressed as the lineal thermal transmittance of the joint in watts per metre Kelvin (to the nearest 0,05 $W \cdot m^{-1} \cdot K^{-1}$).

6.2 Influence of joint on acoustical insulation of the internal wall if any

The influence of the joint is not measured directly. It is only possible to evaluate the insulation between the spaces separated by the internal wall containing the joint.

The measurement is carried out in accordance with ISO 140/4. The result is evaluated according to ISO 717/1 and is expressed in decibels.

6.3 Air permeability of joints (between external and internal environments)

The air permeability of joints is measured in accordance with ISO 6589. For a given pressure expressed in pascals[2)], it is expressed in cubic metres per hour per metre.

6.4 Watertightness

6.4.1 Families of joint (solutions given by way of examples)

Two families of joints are to be distinguished, depending on the way in which they ensure watertightness.

6.4.1.1 Family I ("channel" joints)

The joints comprising family I are those which prevent the passage of air by means of jointing products and which prevent the passage of water by means of "channels" satisfying the following conditions:

a) It is used only when the watertightness of horizontal joints is ensured as described in ISO 7728, subclause 6.4.

b) The "channels" moulded on each side of the joints are at least 15 mm wide and 5 mm deep, are limited by sharp edges (see figures 1 and 2) and, in the lower part of the vertical edges of the panels, are included in the thickness of the upper lip of the horizontal joint (see figure 3).

c) On the external side, the space determined by the "channels" is protected against the direct entry of rain by a strip located in a second pair of "channels" (see figure 1) or by a jointing material (see figure 2).

d) On the internal side, the airtightness jointing material protects the space determined by the "channels" against their infilling by any internal jointing materials and is in continuity with the airtightness jointing material of the horizontal joint. For a pressure of 1 Pa, the airtightness jointing material limits the permeability of the joint to 0,2 $m^3/h/m$.

e) As far as necessary, the watertightness system is supplemented as indicated in 6.4.2.

NOTE — The details shown in figures 1 to 3 are given for information only.

6.4.1.2 Family II (tongue and grooves systems)

The functions comprising family II are those which prevent the passage of air by a jointing material and which prevent the passage of the water by a tongue and grooves system satisfying the following conditions:

a) It is used only when the watertightness of horizontal joints is ensured as described ISO 7728, subclause 6.4.

b) The grooves are made in a durable material. Because of their shape and their position in the edges of the panels, they are anchored in solid concrete (see figure 4).

c) At the bottom of the edges of the panels, they are included in the thickness of the upper lip of the horizontal joint (see figure 5).

1) Many of the characteristics mentioned depend not only on the joint itself, but also on the constitution of the components in the vicinity of their edges.

2) 1 Pa = 1 N/m^2

d) The inserted tongue is made of the same material as that of the grooves. The variations in the width of the joint which it accommodates during mounting and in service vary according to its shape and arrangement. They shall be at least equal to 20 mm.

e) The tongue is effective for the total height of the grooves. It it is not supported so that there is no spontaneous slippage; it shall be held in place by a special device which does not disturb the function of the system.

f) On the internal side, the airtightness jointing material protects the tongue and grooves system against the penetration of internal jointing materials, if any, and is continuous with the airtightness jointing material of the horizontal joint. For a pressure of 1 Pa, the airtightness jointing product limits the air permeability of the junction to 0,2 $m^3/h/m$.

g) As far as necessary, the watertightness system is supplemented as indicated in 6.4.2.

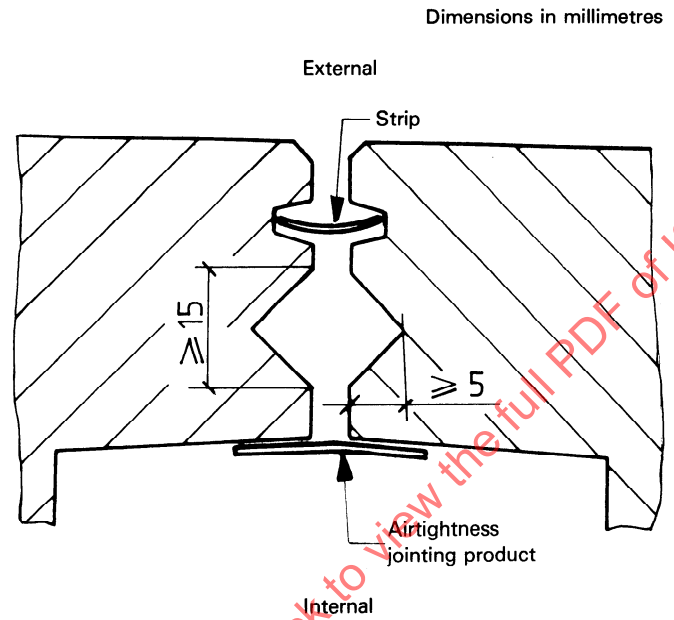

Figure 1 — Horizontal section of vertical joint

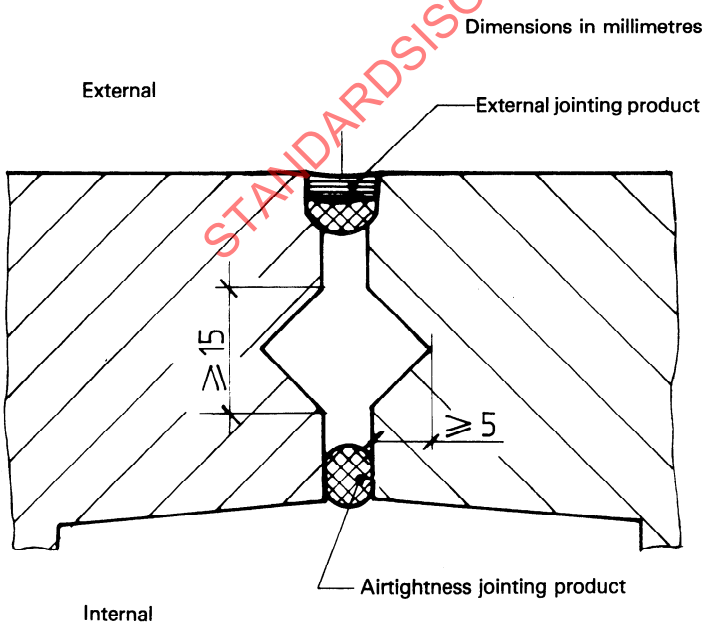

Figure 2 — Horizontal section of vertical joint

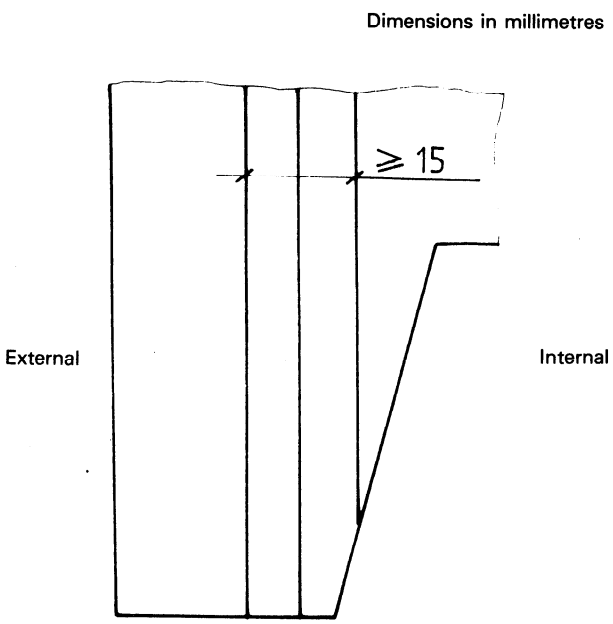

Figure 3 — Vertical section of vertical joint

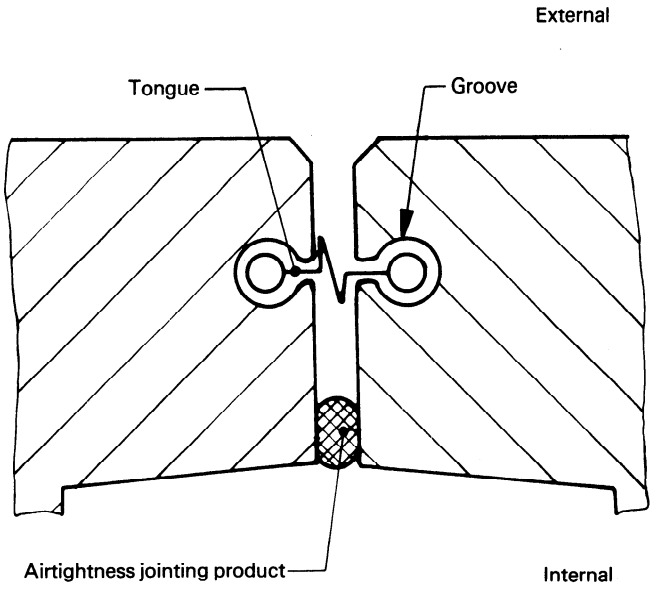

Figure 4 — Horizontal section of vertical joint

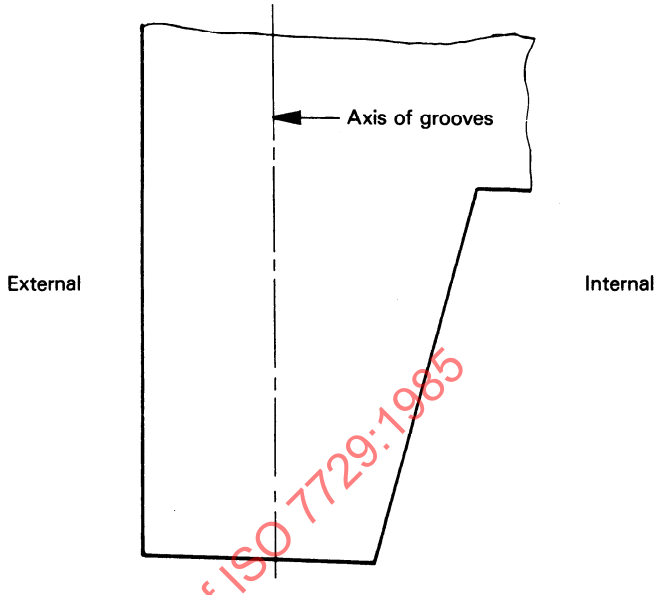

Figure 5 — Vertical section of vertical joint

6.4.2 Supplementary arrangements

If, at the top of the panels, the watertightness channels of family I or the grooves of family II are not located sufficiently far behind the capillary break of the horizontal joint, the vertical joints are closed at their upper end by a durable strip which adheres to the upper edge of the panels up to the top of the lower lip of the horizontal joints and which is in direct or indirect contact with the upper part of the tongue of the joints of family II.

6.5 Water vapour condensation

6.5.1 On the internal face of the wall in the vicinity of the joint (see figure 6, points A).

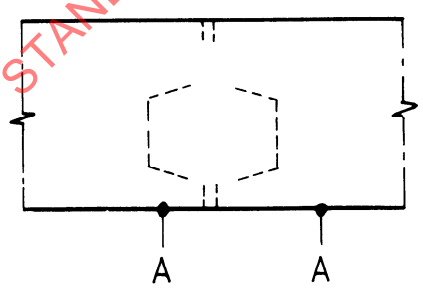

Figure 6 — Water vapour condensation points

An indication of the risk of condensation can be obtained from the superficial temperature factor, μ, given by the formula

$$\mu = \frac{T_1 - \theta_{i\,min}}{T_i - T_e}$$

where

T_i is the internal ambient temperature;

T_e is the external ambient temperature;

$\theta_{i\,min}$ is the lowest surface temperature on the internal face of the wall near the joint.

6.5.2 Inside the joints

No method is given for evaluating the risk of water vapour condensation inside the joints.[1)]

6.6 Transmission of forces

6.6.1 Bracing wall

The characteristics of joints involved in the transmission of forces by a bracing external wall will form the subject of other International Standards.

1) If necessary, this can be evaluated by calculation; the corresponding risk is appreciated by means of the statement of the location of the condensation zone in the joint, and the rate of condensation for defined conditions of temperature and relative humidity of the external and internal environments. This method is rarely applicable, however, with sufficient accuracy.

6.6.2 Supported external wall

For the connection between the external wall and internal walls, if any, the characteristics of resistance and deformability under static and dynamic forces, or impacts applied from the various directions may be determined either in accordance with 6.6.1 or a future International Standard dealing with the mechanical characteristics of fittings.

6.6.3 Other actions

For the connection between adjacent external wall components, if any, the characteristics of resistance and deformability under static and dynamic forces or impacts applied from the various directions may be determined either in accordance with 6.6.1 or a future International Standard.

6.7 Flame resistance

A method for determining the flame resistance of the internal wall, if any, including the joint with the external wall will form the subject of a future International Standard.

Flame resistance is expressed in hours and fractions of hours.

6.8 Emission of gases or toxic fumes in the event of fire

Measurement of the toxicity of pyrolysis and combustion products, together with the opacity of smoke emitted by products in the event of internal fire, will form the subjects of future International Standards.

6.9 Internal and external appearance

No criteria are given for evaluating the initial appearance of the joints.

The risk of modification of the appearance by thermal degradation can be evaluated by means of the thermal heterogeneity coefficient, ϱ, which is given by the formula

$$\varrho = \frac{T_i - \theta_{i\,min}}{T_i - \theta_{i\,max}}$$

where

T_i is the internal ambient temperature;

$\theta_{i\,min}$ is the lowest surface temperature of the internal face of the external wall near the joint;

$\theta_{i\,max}$ is the surface temperature of the typical internal face of the external wall.

6.10 Durability

Measurement of the susceptibility of the jointing products to various aggressive agents will form the subject of a future International Standard.

7 Other indications to be given

7.1 Maintenance of jointing materials

Jointing materials requiring maintenance shall be clearly identified in the description of the joint. The nature of their maintenance as well as the means of access shall be described.

7.2 Replacement of degradable jointing materials

Jointing materials requiring periodic replacement shall be clearly identified in the description of the joint. The procedure for replacement shall be described.

7.3 Dismantling and reassembling components

In the case of constructions or components provided for being dismantled, the arrangements to be made so that the joint actually allows components to be dismantled and reassembled shall be identified in the description of the joint, as well as, if necessary, the number and location of components to be removed before the component considered can be dismantled.

8 Dimensional coordination

The parts of the component determining the joints are defined by the reference planes associated with the components of the external wall (see 9.2)

9 Classification criteria

The classification of joints is established according to the following characteristics:

9.1 Function of the external wall in the structure

The external wall to which the joint belongs may be:

- loadbearing;
- loadbearing and bracing;
- selfsupporting;
- selfsupporting and bracing;
- supported;
- supported and bracing.

9.2 Position of joint relative to reference planes (see figure 7)

This position is characterized by the distance a between the axis of watertightness channels or grooves and the vertical reference plane of the external wall, as well as by the distance b between the axis of the vertical joint and the reference plane associated with the vertical edge of the external wall components.

9.3 Position of joint in relation to the building

The joint may be

— a joint without relation to an interior wall or post,

— a joint in front of an interior wall or post.

9.4 Families of joints (see 6.4.1)

The joints belongs to either

— family I,

— family II.

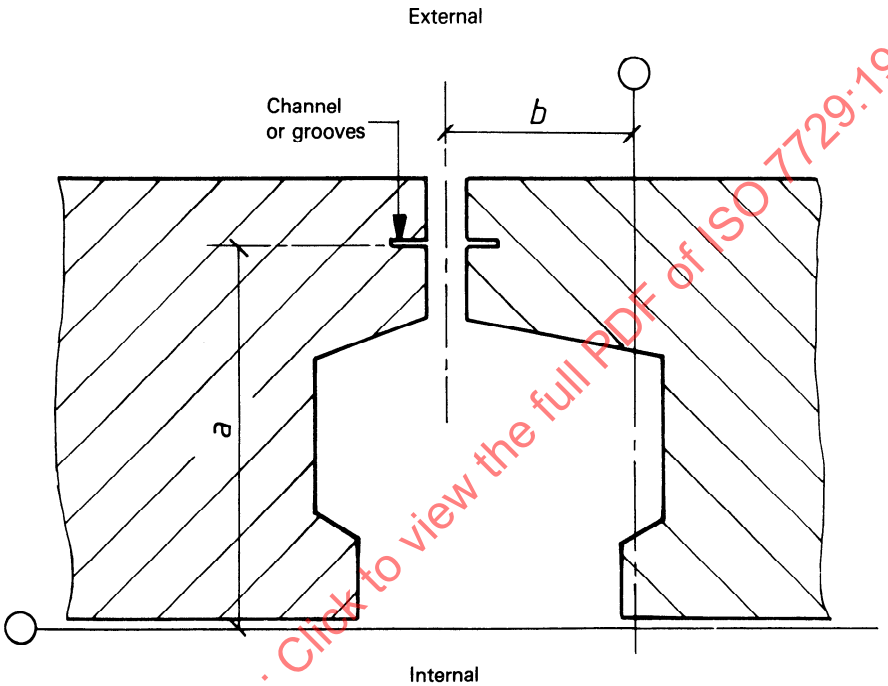

Figure 7 — Horizontal section of joint