



# SLOVENSKI STANDARD

## SIST EN 16497-1:2015

01-april-2015

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### Dimniki - Sistemski dimniki iz betona - 1. del: Tlačno neizravnani dimniški sistem

Chimneys - Concrete System Chimneys - Part 1: Non-balanced flue applications

Abgasanlagen - System-Abgasanlagen aus Beton - Teil 1: Raumluftabhängige Anwendungen

Conduits de fumée - Conduits-systèmes de fumée en béton - Partie 1: Applications non équilibrées

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Ta slovenski standard je istoveten z: <sup>SIST EN 16497-1:2015</sup> EN 16497-1:2015

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#### ICS:

91.060.40	Dimniki, jaški, kanali	Chimneys, shafts, ducts
91.100.30	Beton in betonski izdelki	Concrete and concrete products

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EUROPEAN STANDARD

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February 2015

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## Chimneys - Concrete System Chimneys - Part 1: Non-balanced flue applications

Conduits de fumée - Conduits-systèmes de fumée en béton  
- Partie 1: Applications non équilibrées

Abgasanlagen - System-Abgasanlagen aus Beton - Teil 1:  
Raumluftabhängige Anwendungen

This European Standard was approved by CEN on 29 November 2014.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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**EN 16497-1:2015 (E)****Foreword**

This document (EN 16497-1:2015) has been prepared by Technical Committee CEN/TC 166 “Chimneys”, the secretariat of which is held by ASI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by August 2015 and conflicting national standards shall be withdrawn at the latest by November 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Regulations.

For relationship with EU Regulations, see informative Annex ZA, which is an integral part of this document.

This standard is one of a series of co-ordinated standards dealing with specification, design, and testing of chimneys, both single and multi-wall.

The co-ordinated package of standards is further divided by material of construction and this European Standard is one of a series of specifications and execution documents dealing with design and installation of concrete chimney products and systems.

The standards in this series for concrete chimney products and systems are:

- EN 1857, *Chimneys — Components — Concrete flue liners*
- EN 1858, *Chimneys — Components — Concrete flue blocks*
- EN 12446, *Chimneys — Components — Concrete outer wall elements*
- CEN/TS 16134, *Chimney terminals — General requirements and material independent test methods*
- EN 16497-1, *Chimneys — Concrete system chimneys — Part 1: Non-balanced flue applications*
- prEN 16497-2, *Chimneys — Concrete system chimneys — Part 2: Balanced flue applications*

NOTE A chimney in accordance with EN 16497-1 can also be used for room-sealed applications using a separate combustion air supply in a non-balanced flue configuration.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

## 1 Scope

This European Standard specifies the materials and the dimensional and performance requirements for straight concrete system chimneys for non-balanced flue applications comprising a concrete flue liner and a combination of compatible chimney components, which may be concrete flue blocks (see Clause 4), obtained or specified from one manufacturing source with product responsibility for the whole chimney.

This European Standard does not apply to concrete system chimneys with back ventilation.

This European Standard does not cover products designated wet (W) in conjunction with corrosion class 3.

This European Standard also applies to concrete system chimneys constructed from storey-height elements and flue blocks reinforced for handling.

NOTE Any reference to the term flue blocks implies both flue blocks and their fittings, except where otherwise indicated.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1443:2003, *Chimneys - General requirements*

EN 13216-1, *Chimneys - Test methods for system chimneys - Part 1: General test methods*

EN 13384-1, *Chimneys - Thermal and fluid dynamic calculation methods - Part 1: Chimneys serving one appliance*

EN 14297:2004, *Chimneys - Freeze-thaw resistance test method for chimney products*

EN ISO 7500-1, *Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system (ISO 7500-1)*

ISO 2859-1, *Sampling procedures for inspection by attributes - Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1443:2003 and the following apply.

### 3.1

#### **flue block fitting**

element fitted to the flue block

Note 1 to entry: Such as an access opening or offset.

### 3.2

#### **hollow wall flue block**

flue block having vertical cavities

Note 1 to entry: Cavities may pass through both ends of the block.

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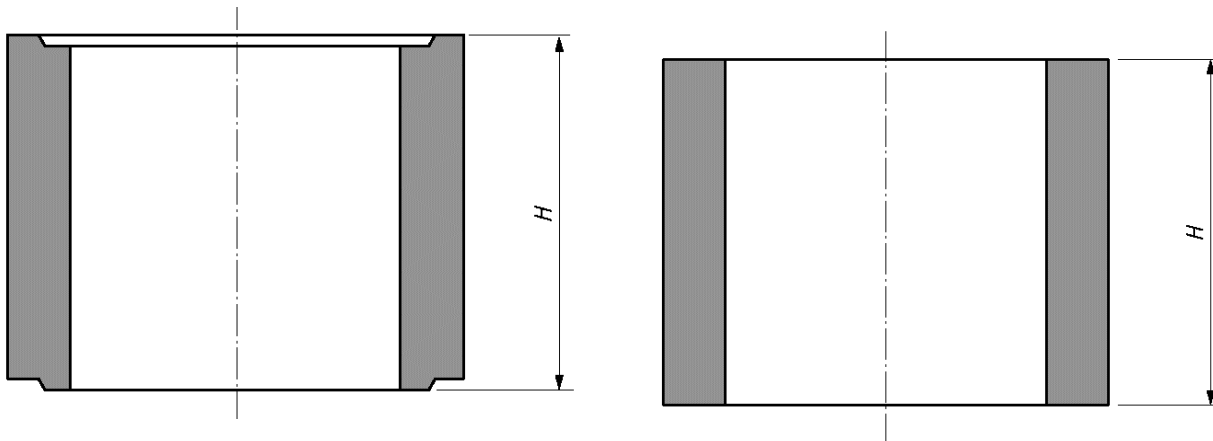
### 3.3 declared internal transverse dimension

internal dimension of the flue block measured perpendicular to the longitudinal axis

### 3.4 declared height

internal height of the flue block

Note 1 to entry: Examples of measurement are shown in Figure 1.



a) with rebate

b) with plain end

#### Key

H internal height

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**Figure 1 — Manufacturer's declared height**

### 3.5 manufacturer's declared structural height

maximum constructional height of the flue blocks as declared by the manufacturer

### 3.6 overall wall thickness

dimensions at its thinnest point, between the inside face of the flue and the outside face of the flue block, not measured at any joint feature

Note 1 to entry: Joint features include a spigot/socket end etc.

### 3.7 multi-wall flue block

flue block consisting of a flue liner and at least one additional wall

### 3.8 reinforced flue block

flue block having reinforcement to assist handling (not for structural stability)

### 3.9 solid wall flue block

flue block without cavities in the thickness of its walls



**3.10****straight flue block**

flue block designed to be used in a vertical section of a chimney, without having any special characteristics and having the ends perpendicular to the axis of the flue

**3.11****storey-height flue block**

factory made flue block having an overall height relating to the floor to floor height of a building

**3.12****transfer block**

flue block designed to facilitate connection to another chimney product

**3.13****concrete**

material formed by mixing cement, coarse and fine aggregate and water with or without the incorporation of admixtures or additions, which develops its properties by hydration of the cement

[SOURCE: EN 206:2013, 3.1.1.1]

**3.14****precast concrete**

concrete that is cast in a place other than its final location of use

**3.15****balanced flue chimney system**

system where the air entry to the combustion air supply duct is adjacent to the discharge of combustion products from the flue, the inlet and outlet being so positioned that wind effects are substantially balanced

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**4 Form**

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The concrete system chimney shall comprise of flue blocks, which may be of single wall or multi-wall construction.

In the context of this standard the term 'flue block' means a vertical element of a system chimney which may also comprise the following items where appropriate:

- flue blocks in accordance with EN 1858;
- flue liners in accordance with EN 1857;
- insulation layer;
- outer wall elements in accordance with EN 12446, or EN 13069, or of appropriate metal;
- mortar for jointing flue liners;
- mortar for jointing a flue block or outer wall elements;
- terminal in accordance with TS 16134;
- chimney base;
- cladding;
- opening section;
- reinforcement for handling.

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Single wall or multi-wall flue blocks shall be manufactured in one of the following forms:

- single flue;
- multi-flue;
- flue/ventilation combination.

See Annex B for examples of typical flue block types.

Flue blocks shall have a maximum of four flues or ventilation passages.

**5 Materials****5.1 General**

The wall or walls of concrete flue liners or concrete flue blocks shall be precast concrete. For multi-wall concrete flue blocks the concrete liner and outer wall may be separated by an air space or insulation.

Materials used in the manufacture of system chimneys shall be identified for factory production control purposes.

When insulation forms part of a system chimney, it shall be of bonded material as specified by the manufacturer. If the insulation is supplied as a separate item, it shall be installed in accordance with the system chimney manufacturer's installation instructions.

The density of any insulation and the bulk density of the concrete elements shall be declared and when tested to A.11 the density shall be within  $\pm 10\%$  of the declared value (see 8.10).

Where a system chimney to this standard comprises CE marked chimney components in accordance with Clause 4, the above requirements are deemed to be satisfied.

Products bearing regulatory marking in accordance with appropriate harmonized European specifications may be presumed to have the performances declared in the Declaration of Performance (DoP), although this does not replace the responsibility on the concrete system chimney manufacturer to ensure that the concrete system chimney as a whole is correctly manufactured and its component products have the declared performance values.

**5.2 Reaction to fire**

In accordance with the Commission Decision 96/603/EC, as amended, concrete elements of system chimneys to this standard are classified as reaction to fire class A1 without tests provided they contain no more than a mass or volume fraction of 1% (whichever is the more onerous) of homogeneously distributed organic materials.

**5.3 Reinforcement for handling**

**5.3.1** Where a concrete element is reinforced for handling, the reinforcement shall have a maximum diameter of 8 mm and a minimum concrete cover of 15 mm on all sides for temperature classes up to and including T250 and a minimum concrete cover of 20 mm on all sides for all other temperature classes.

**5.3.2** For concrete elements with a bulk density of less than 2 000 kg/m<sup>3</sup>, when measured in accordance with A.10, any reinforcement shall be protected against corrosion by one of the following means:

- a) use of stainless steel;

- b) by completely covering any mild steel reinforcement with a coating (e.g. typically Portland cement CEM I or CEM II mixed with water to form a slurry, or epoxy resin).

CE marked chimney components are deemed to satisfy these requirements.

## 6 Surface treatment

Any surface treatment of the concrete elements, e.g. render, shall be applied, as described by the product manufacturer, before the product is tested.

## 7 Tolerances on dimensions of individual concrete components

NOTE CE marked chimney components are deemed to satisfy these requirements.

### 7.1 Declared dimensions

Tolerances on manufacturer's declared dimensions, including taper, shall be:

- a) Declared internal transverse dimensions below

300 mm:  $\pm 3$  mm

above 300 mm:  $\pm 1,5\%$

- b) Declared height

below 300 mm:  $\pm 5$  mm

300 mm to 700 mm:  $\pm 7$  mm

above 700 mm:  $\pm 10$  mm

- c) Storey height elements constructed from individual blocks

Declared height up to 3 m:  $\pm 10$  mm

Declared height over 3 m:  $\pm 30$  mm

- d) Declared overall wall thickness

below 10 mm:  $\begin{matrix} +1 \\ -2 \end{matrix}$  mm

10 mm to 40 mm:  $\begin{matrix} +5 \\ -1,5 \end{matrix}$  mm

above 40 mm:  $\begin{matrix} +12\% \\ -5 \end{matrix}$

### 7.2 Straightness

**7.2.1** When tested as described in A.2, the limit deviation from the straightness of a straight concrete flue block of manufacturer's declared height, greater than 300 mm and less than 1 000 mm, shall not be greater than 1 % of the declared height.

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**7.2.2** When tested as described in A.2, for flue blocks having a manufactured height equal to or greater than 1 000 mm, the limit deviation shall not be greater than 0,5 % of the manufacturer's declared height.

**7.3 Squareness of ends**

When tested in accordance with either procedure described in A.1, the test sample shall not touch the upright for the first procedure and the dimension shall not be greater than 5 mm for the second procedure.

**8 Performance****8.1 Heat stress resistance**

**8.1.1** When concrete system chimneys, including those designated soot fire resistant, are tested for heat stress resistance in accordance with A.3, at the test temperature appropriate to the designation specified in Table 1, the system chimney shall subsequently meet the requirements of 8.4 and 8.5.

When a concrete system chimney is multi-flued with an equal wall thickness, the heat stress test shall be carried out on the flue with the highest designation and temperature.

**8.1.2** The distance to combustible material, *xx*, shall be declared. The maximum temperature measured on the surface of adjacent combustible materials shall not exceed 85 °C when related to an ambient temperature of 20 °C.

**8.2 Heat shock resistance**

**8.2.1** Following the heat stress resistance test in 8.1, when a concrete system chimney designated as soot fire resistant is tested for heat shock resistance in accordance with A.3, at a flue gas temperature of 1 000 °C for a period of 30 min ± 1 min, the block shall subsequently meet the requirements of 8.4 and 8.5.

**8.2.2** The distance to combustible material, *xx*, shall be declared. The maximum temperature measured on the surface of adjacent combustible materials shall not exceed 100 °C when related to an ambient temperature of 20 °C, when the test assembly is tested at the test temperature of 1 000 °C over a period of 30 min ± 1 min.

**Table 1 — Heat stress test temperature**

Temperature group	Temperature of flue gas °C
T600	700 <sup>+50</sup> <sub>0</sub>
T450	500 <sup>+50</sup> <sub>0</sub>
T400	500 <sup>+50</sup> <sub>0</sub>
T300	350 <sup>+35</sup> <sub>0</sub>
T250	300 <sup>+30</sup> <sub>0</sub>
T200	250 <sup>+25</sup> <sub>0</sub>

T160	190 <sup>+19</sup> <sub>0</sub>
T140	170 <sup>+17</sup> <sub>0</sub>
T120	150 <sup>+15</sup> <sub>0</sub>
T100	120 <sup>+12</sup> <sub>0</sub>
T080	100 <sup>+10</sup> <sub>0</sub>

### 8.3 Thermal resistance

Thermal resistance shall be measured in accordance with the method given in A.4 (reference method) or calculated in accordance with the method given in Annex C and the value obtained declared.

The value for CE marked flue block chimney components may be used.

### 8.4 Gas tightness

When tested in accordance with A.5, the gas tightness expressed as a leakage rate of the flue block shall not be greater than the values specified in Table 4 for the relevant gas tightness class before and after the thermal performance tests.

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For factory production control the test sample may be one element.

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### 8.5 Abrasion resistance

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All flue blocks having satisfied the gas tightness requirements of 8.4, when tested in accordance with A.6, the weight of the deposit collected shall not exceed the values in Table 2, and shall subsequently meet the gas tightness requirements of 8.4.

Table 2 — Abrasion resistance

Dry density kg/m <sup>3</sup>	Maximum abrasion of inner surface kg/m <sup>2</sup>
1 000	1 000
1 100	1 100
1 200	1 200
1 300	1 300
1 400	1 400
1 500	1 500
1 600	1 600
1 700	1 700
1 850	1 850

CE marked chimney components are deemed to satisfy these requirements

**EN 16497-1:2015 (E)****8.6 Compressive strength**

The manufacturer shall declare the structural height. When tested in accordance with A.7, straight flue blocks and straight fittings shall withstand an intensity of loading equivalent to four times the declared structural height.

The declared structural height is dependent on the lowest compressive strength of the individual walls of the flue block, and/or any opening element.

The value of CE marked chimney components may be used

The declared structural height can be derived from the ultimate compressive strength determined by the method in A.12.

**8.7 Corrosion resistance**

When flue blocks designated condensate resistance class W (suitable for use in wet operating conditions) are tested as described in A.8, flue blocks shall be designated corrosion class 1 or class 2 depending on the test solution used, provided that the mass loss of the test pieces is not greater than 0,1 % of the initial mass.

Flue blocks designated condensate resistance class D (dry) and which meet the requirements of 8.1 and 8.2, may be assigned corrosion resistance class 3.

CE marked chimney components are deemed to satisfy these requirements.

**8.8 Condensate resistance**

When flue blocks designated W (suitable for use in wet operating conditions) are tested as described in A.8, the maximum amount of test solution passing through the wall of the flue block during any 24 ( <sup>+2</sup><sub>0</sub> )h test period shall not be greater than 0,5 gh<sup>-2</sup> m<sup>2</sup> of the flue block external surface.

Otherwise the flue block shall be designated D (dry).

CE marked chimney components are deemed to satisfy these requirements.

**8.9 Water vapour diffusion resistance**

When flue blocks designated W are tested in accordance with A.9 the maximum amount of test solution passing through the wall of the flue block during any 24 ( <sup>+2</sup><sub>0</sub> )h test period shall not be greater than 0,5 gh<sup>-1</sup>m<sup>-2</sup> of the flue block external surface.

The flue block shall show no water vapour saturation in any part of the chimney.

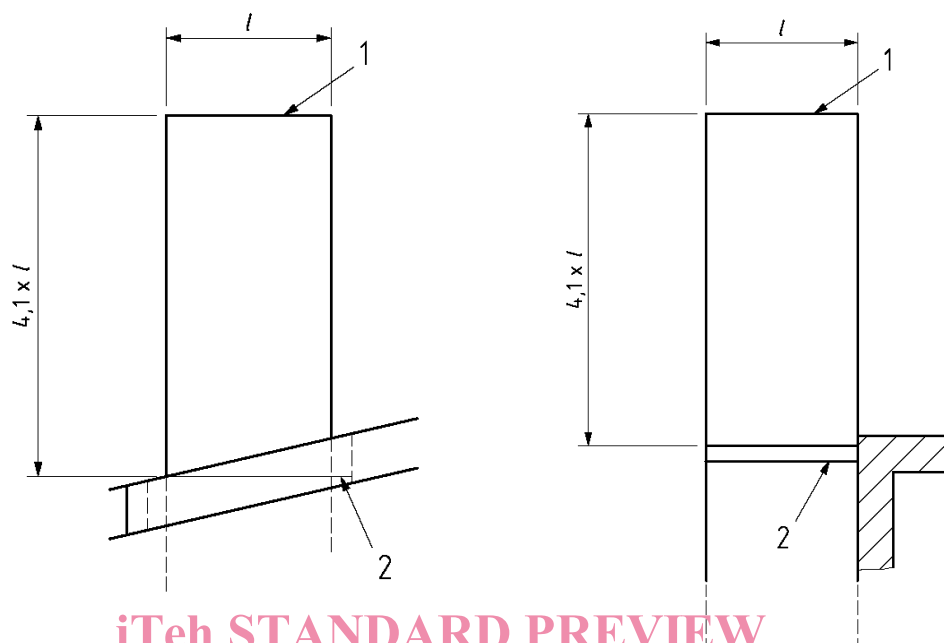
**8.10 Bulk density**

When concrete components are tested as described in A.11, the lowest and highest bulk density value shall be within a limit deviation of ± 10 % of the declared bulk density for the component.

**8.11 Flexural strength under wind loading**

The maximum free standing height of flue blocks shall be no greater than 4,5 times the least lateral overall external dimension of the flue block from the last point of lateral support (see Figure 2).

Alternatively, the free standing part of the chimney above the last lateral support of the concrete flue block shall withstand a wind load of  $1,5 \text{ kN/m}^2$  (or a value in accordance with national regulations), when tested in accordance with A.10.



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#### Key

- 1 top of chimney excluding any terminal or chimney pot
- 2 last point of support
- l least lateral overall external dimension of the flue block

Figure 2 — Explanation of last point of support

## 8.12 Flow resistance

### 8.12.1 Flow resistance of straight flue blocks

The mean value of roughness for a straight flue block shall be determined either:

- a) by testing in accordance with EN 13216-1 (being the reference method), or
- b) from data obtained from EN 13384-1.

Where the system chimney comprises of CE marked flue blocks in accordance with Clause 4 the values obtained from the products may be used.

### 8.12.2 Flow resistance of fittings

The coefficient of flow resistance due to a directional and/or cross sectional and/or mass flow change shall be determined either:

- a) by testing in accordance with EN 13216-1 (being the reference method), or
- b) from data obtained from EN 13384-1.