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BSI Standards Publication

Chimneys — Concrete System Chimneys

Part 2: Balanced flue applications

bsi.

National foreword

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European foreword

This document (EN 16497-2:2017) 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of an identical text or by endorsement, at the latest by September 2017, and conflicting national standards shall be withdrawn at the latest by December 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN 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 Directive(s).

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

In this European Standard, the Annexes A, C and D are normative (not forming part of the product specification) and Annexes E and ZA are informative.

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

The coordinated 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.*

EN 16497-1, Chimneys — Concrete system chimneys — Part 1: Non-balanced flue applications

EN 16497-2, Chimneys — Concrete system chimneys — Part 2: Balanced flue applications

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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

1 Scope

This European Standard specifies the materials, dimensional and performance requirements for straight concrete system chimneys for balanced flue applications comprising a concrete flue liner and a combustion air supply duct, 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.

The 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.

This European Standard does not apply to structurally independent (free standing or self-supporting) system chimneys.

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 206:2013+A1:2016, *Concrete — Specification, performance, production and conformity*

EN 1443, *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 heating appliance*

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

CEN/TS 16134:2011, *Chimney terminals — General requirements and material independent test methods*

EN ISO 7500-1:2015, *Metallic materials — Calibration and verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Calibration and verification of the force-measuring system (ISO 7500-1:2015)*

ISO 2859-1:1999, *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 and the following apply.

3.1
flue block fitting
element fitted to the flue block such as an access opening or offset

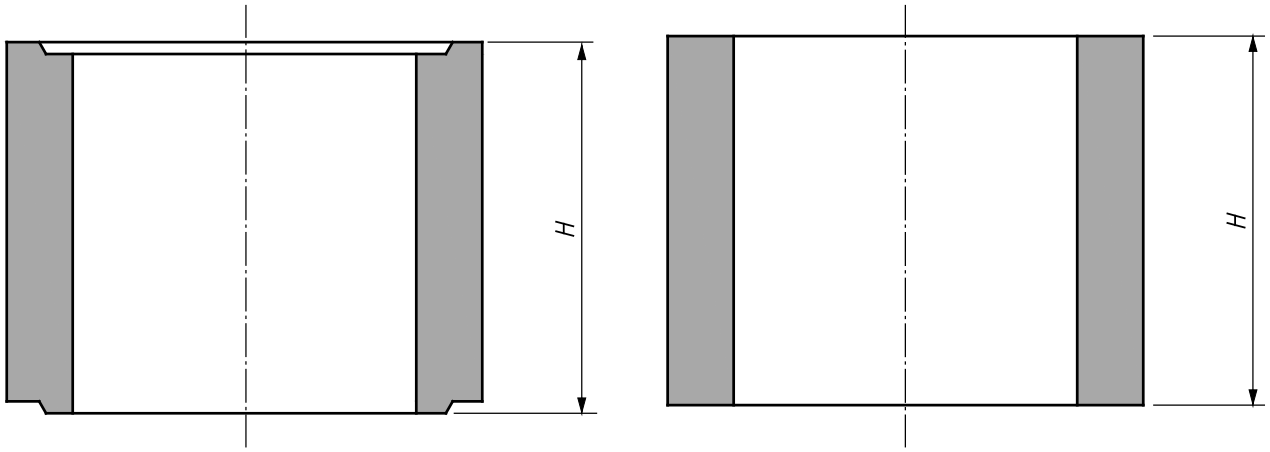
3.2
hollow wall flue block
flue block having vertical cavities

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

3.3
manufacturer's declared internal transverse dimension
internal dimension of the flue block measured perpendicular to the longitudinal axis

3.4
manufacturer's 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

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
manufacturer's declared 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: Examples for joint features are spigot/socket end

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, aggregate and water and with or without the incorporation of admixtures or additions, which develops its properties by hydration

[SOURCE: EN 206:2013+A1:2016, 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 form the flue, the inlet and outlet being so positioned that wind effects are substantially balanced

4 Form

The concrete system chimney for balanced flue applications shall comprise of flue blocks, which may be of single wall or multi wall construction, and a combustion air supply duct.

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 according to EN 1858

— Flue liners according to EN 1857

— Insulation layer;

— outer wall elements according to 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;

— chimney base;

— cladding;

— opening section;

— reinforcement for handling.

— Pressure equalising opening

— Combustion air supply duct.

This duct may be an additional passage within a flue block, or a separate duct, possibly of other materials.

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

— single flue;

— multi-flue;

— flue/combustion air/ventilation combination.

NOTE See Annex B for examples of typical flue block types.

Flue blocks shall have a maximum of four flues, combustion air 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 multiwall concrete flue blocks the concrete liner and outer wall may be separated by an air space or insulation.

The material of a separate combustion air supply duct may be same as the flue liner or flue block or be of other materials, e.g. metal tube, but it shall have the appropriate resistance to fire external to external.

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 manufacturer shall declare the density of any insulation and the bulk density of the concrete elements and when tested to A.11 the density shall be within ± 10 % of the declared value (see 8.10).

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

5.2 Reaction to fire

In accordance with Commission Decision 96/603/EC, as amended, concrete elements of system chimneys to this standard are classified as reaction to fire class A1 without test provided they contain

not 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 In concrete elements having a bulk density of less than 2 000 kg/m^3, 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

7.1 Declared dimensions

CE-marked chimney components according to EN 1857, EN 1858, EN 12446 and EN 16497-1 are deemed to satisfy these requirements.

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

a) Declared internal transverse dimensions

   below 300 mm : ± 3 mm

   300 mm and above : ± 1,5 %

b) Declared height

   below 300 mm : ± 5 mm

   300 mm to 700 mm : ± 7 mm

   above 700 mm : ± 10 mm

c) Storey height elements constructed from individual blocks

   Declared height up to 3 m ± 10 mm

   Declared height over 3 m ± 30 mm

d) Declared overall wall thickness

below 10 mm : $^{+1}_{-2}$ mm

10 mm to 40 mm : $^{+5}_{-1,5}$ mm

above 40 mm : $^{+12}_{-5}$ %

The tolerances of other materials e.g. metal ducts shall be according to the relevant chimney standard for that material.

7.2 Straightness

7.2.1 When tested as described in A.2, the limit deviation from straightness of a straight concrete components 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.

7.2.2 When tested as described in A.2 for concrete components having a manufactured height equal to or greater than 1 000 mm, the limit deviation shall not be greater than 0,5 % of the manufacturers 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 G 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 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 as described in 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.

Table 1 — Heat stress test temperature

Temperature group	Temperature of flue gas °C
T600	700^{+50}_{0}
T450	550^{+50}_{0}
T400	500^{+50}_{0}
T300	350^{+35}_{0}
T250	300^{+30}_{0}
T200	250^{+25}_{0}
T160	190^{+19}_{0}
T140	170^{+17}_{0}
T120	150^{+15}_{0}
T100	120^{+12}_{0}
T080	100^{+10}_{0}

8.3 Thermal resistance

Thermal resistance of the flue duct 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 of the flue duct expressed as a leakage rate of the flue duct shall not be greater than the values specified in Table 4 for the relevant gas tightness class before and after the thermal performance tests.

When tested in accordance with A.5 the gas tightness of the combustion air supply duct expressed as a leakage rate of the combustion air supply duct shall not be greater than the value for N_2 specified in Table 4 before and after the thermal performance tests.

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

8.5 Abrasion resistance

All flue ducts having satisfied the gas tightness requirements of 8.4, when tested as described in 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/m³	**Maximum abrasion of inner surface** kg/m²
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

8.6 Compressive strength

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

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

8.7 Corrosion resistance

When flue duct designated condensate resistance class W (suitable for use in wet operating conditions) are tested as described in Clause A.8, flue duct 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 ducts 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 duct designated W (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 duct during any 24 (−0 +2h) test period shall not be greater than 0,5 $gh^{-1}m^{-2}$ of the flue duct external surface.

Otherwise the flue duct shall be designated D (dry)

CE-marked chimney components are deemed to satisfy these requirements

8.9 Water vapour diffusion resistance

When flue duct designated W are tested according to A.9 the maximum amount of water vapour saturation passing through the wall of the flue block during any 24 (−0 +2h) test period shall not result in liquid on the surface greater than 0,5 $gh^{-1}m^{-2}$ of the flue block external surface

Otherwise the flue duct shall be designated D (dry)

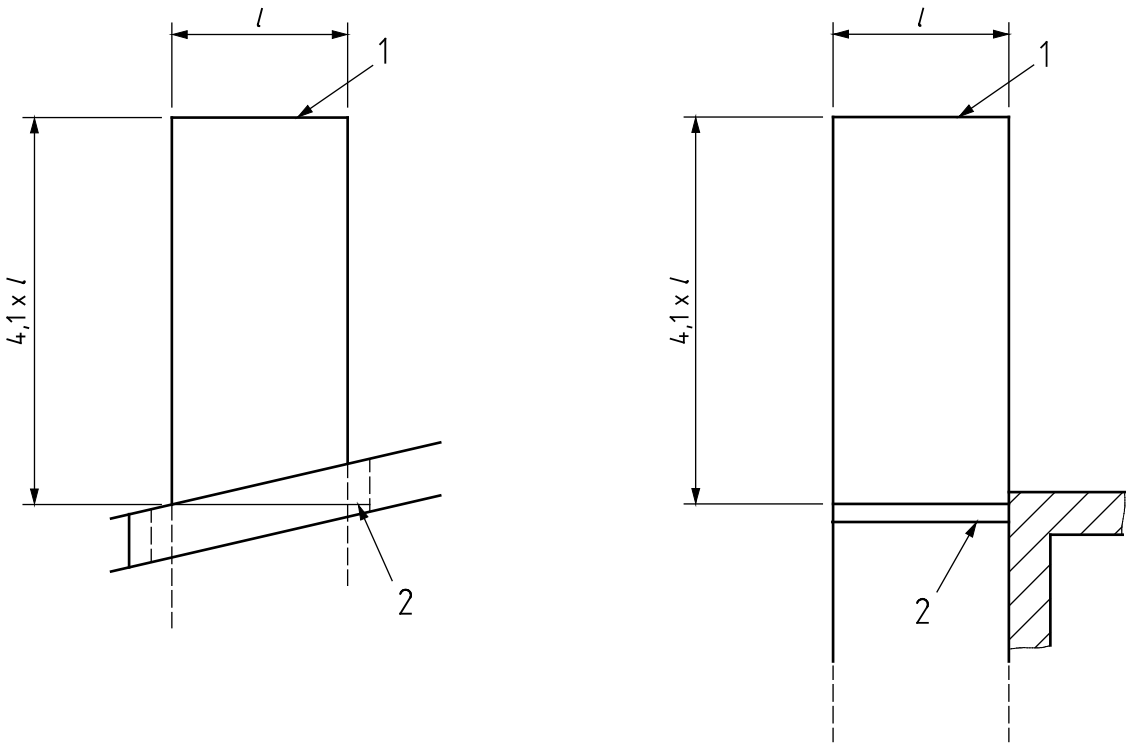
8.10 Bulk density

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 manufacturer's declared bulk density for the component.

8.11 Flexural strength under wind loading

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

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



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 duct (r_F)

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

a) by testing in accordance with EN 13216-1, or

b) from data obtained from EN 13384-1.

Values obtained from CE marked products may be used

8.12.2 Flow resistance of straight air supply duct (r_A)

The mean value of roughness for a straight air supply duct shall be determined either:

a) by testing in accordance with EN 13216-1, or

b) from data obtained from EN 13384-1.

Values obtained from CE marked products may be used

8.12.3 Flow resistance of fittings

The coefficient of flow resistance of either the flue duct (ζ_F)or the air supply duct (ζ_A) 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, or

b) from data obtained from EN 13384-1.

Values obtained from CE marked products may be used

8.13 Freeze–thaw resistance

Where national regulations require freeze/thaw resistance of flue blocks, they shall be tested in accordance with EN 14297. The product shall not present any damage of type 7, 8, 9 and 10 in accordance with EN 14297:2004, Table 1.

CE-marked chimney components designated freeze/thaw resistant are deemed to satisfy these requirements

8.14 Resistance to fire external to external

Where national regulations require resistance to fire external to external (see EN 1443) of flue blocks, they shall be evaluated and declared in accordance with those regulations.

8.15 Dangerous substances

Materials used in products shall not release any dangerous substances in excess of the maximum permitted levels specified in a relevant European Standard for the material, or permitted in the national regulations of the member state of destination.

NOTE See note 2 in ZA.1.

8.16 Relative movement between inner liner and outer wall

After thermal testing (heat stress and where appropriate heat shock) in accordance with EN 13216-1, the final position after cooling down to room temperature of the upper flue liner shall be ± 5 mm to the original position

8.17 Terminals

8.17.1 Type III

A terminal for balanced flue applications, shall be tested for flow resistance and for wind velocity pressure at least. The terminal may be additional tested for rainwater ingress and icing behaviour.

NOTE This corresponds to Type III defined in CEN/TS 16134.

8.17.2 Flow resistance of terminals

The flow resistance of the terminal shall be determined according to CEN/TS 16134.

8.17.3 Wind velocity pressure of type III terminals

The manufacturer shall declare the coefficient of wind velocity pressure for wind direction characteristics specified, determined in accordance with 8.2.2 of CEN/TS 16134:2011.

The following requirements for the coefficient of wind velocity pressure cFA apply:

— $c_{FA} \leq 0{,}6$ for all terminals and wind attack angles and

— $c_{FA} \geq 0$ for terminals for chimneys operating under negative and positive pressure.

8.17.4 Recirculation factor of type III termination

The manufacturer shall declare the recirculation factor, determined in accordance with CEN/TS 16134:2011, 8.2.3.

The recirculation factor is limited by the appliance the terminal shall be used.

8.17.5 Pressure equalising opening

For multi inlet air - flue chimneys the manufacturer shall declare the size of the pressure equalising opening. The cross section of the pressure equalising opening shall be at least 15 % of the cross section of the flue liner.

For multi inlet air - flue chimneys working under overpressure no pressure equalising opening is allowed.

The distance between the pressure equalising opening and the lowest inlet shall be 1,5 m for dry operating chimneys and 2,5 m for wet operating chimneys.

This distance may be reduced to half if the inlet is equal to or less than 45°.

No equalising openings are necessary for single inlet chimneys.

8.17.6 Rainwater ingress

A terminal declared to be rainwater resistant shall be tested in accordance with CEN/TS 16134 with or without wind according to the manufacturer's declaration.

For a chimney designated D, no more than 0,05 mm^3/s of rainwater per mm of the nominal diameter of the flue shall enter the flue outlet or the air inlet.

For a chimney designated W, no more than 0,05 mm^3/s of rainwater per mm of the nominal diameter of the flue shall enter the air inlet.

In an air duct of a terminal Type III the volume of the water collected in the air supply duct shall also not exceed 0,05 mm^3/s related to the declared internal diameter in mm. For variations in the form from a circle the hydraulic internal diameter has to be taken

8.17.7 Icing behaviour

A terminal declared to be resistant to icing shall be tested in accordance with Annex E of CEN/TS 16134:2011.

The test shall satisfy the following requirements:

— the increase in weight of the tested flue terminal shall not exceed 0,5 g for each mm of the nominal diameter of the flue;

— the dimension of any ice formation, measured in the flue in any direction on or in the terminal, shall not exceed 10 mm.

9 Designation

9.1 General

All concrete flue blocks conforming to this standard shall be designated in accordance with 9.2 to 9.6 for temperature, pressure, resistance to soot fire, condensate resistance and corrosion resistance respectively.

NOTE An example of a designation system is given in Figure 3.

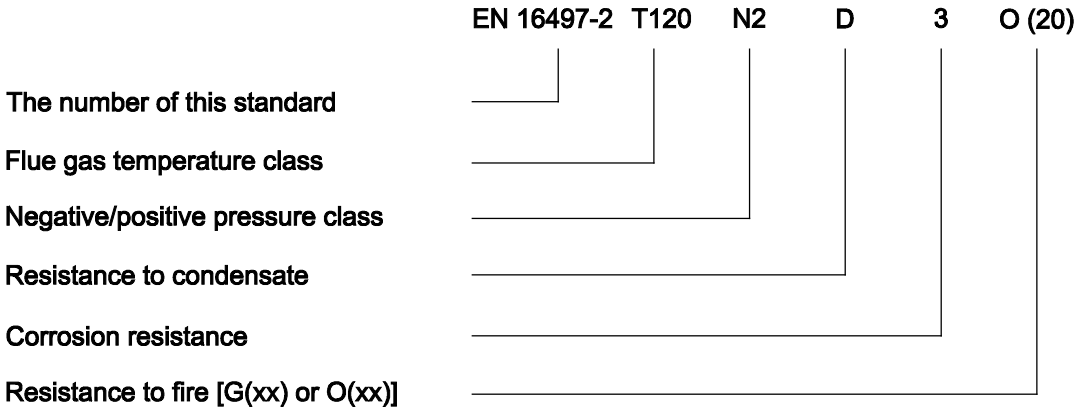


Figure 3 — Example of a designation system

9.2 Temperature class

The temperature class shall be as given in Table 3.

Table 3 — Temperature class

Temperature class	Nominal working temperature °C
T080	≤ 80
T100	≤ 100
T120	≤ 120
T140	≤ 140
T160	≤ 160
T200	≤ 200
T250	≤ 250
T300	≤ 300
T400	≤ 400
T450	≤ 450
T600	≤ 600

9.3 Pressure class

The pressure class shall be as follows, with the corresponding test pressure and gas tightness level as given in Table 4:

— for flue blocks suitable for negative pressure chimneys: N1, N_2;

— for flue blocks suitable for positive pressure chimneys: P1, P2;

— for flue blocks suitable for high positive pressure chimneys: H1, H2.

Table 4 — Pressure classes and gas tightness

Pressure class	Test pressure Pa	Gas tightness – Maximum leakage rate l/s/m²
N1	40	2,0
N_2	20	3,0
P1	200	0,006
P2	200	0,120
H1	5 000	0,006
H2	5 000	0,120

9.4 Resistance to condensate class

The resistance to condensate class shall be as follows:

— W for flue blocks for chimneys intended to operate under wet conditions;

— D for flue blocks for chimneys intended to operate under dry conditions.

9.5 Corrosion resistance class

Corrosion resistance classes for chimneys which convey products of combustion from gas or light oils and natural wood or heavy oils and solid mineral fuels shall be as given in Table 5 (see 8.7).

Table 5 — Corrosion resistance classes

Fuel Types	1 possible fuel types	2 possible fuel types	3 possible fuel types
gas	gas: sulphur-content ≤ 50 mg/m³ natural gas L + H	gas natural gas L + H	gas natural gas L + H
liquid	kerosene: sulphur-content ≤ 50 mg/m³	oil: sulphur-content ≤ 0,2 mass % kerosene: sulphur-content > 50 mg/m³	oil: sulphur-content > 0,2 mass % kerosene: sulphur-content > 50 mg/m³
wood		wood in open fire places	wood in open fire places wood in closed stoves
coal			Coal
peat			Peat

NOTE Table 5 does not categorize process gases or liquids.

9.6 Resistance to fire class

Resistance to fire class shall be as follows:

— O (xx) for flue blocks for chimneys without sootfire resistance;

— G (xx) for flue blocks chimneys with sootfire resistance.

Where (xx) is the distance to combustible material in mm.

10 Marking

The manufacturer shall make available a chimney plate made of a durable material that shall include the following information:

— name or trademark of the manufacturer, engraved or indelibly marked;

— nominal size;

— date of manufacturing or batch number;

— space for installer data and date of installation.

NOTE For CE marking and labelling, Clause ZA.3 applies.

11 Product information

The manufacturer's printed literature for the product shall include the following:

a) manufacturer's product description;

b) manufacturer's declared sizes;

c) manufacturer's designation;

d) distance to combustibles and how it was obtained (i.e. in which test assembly);

e) thermal resistance of the flue duct;

f) manufacturer's declared internal transverse dimensions, height, structural height and overall wall thickness;

g) detailed installation instructions including method of jointing and flue duct identification.

h) characteristics of any terminal, e.g. whether rainwater resistant, aerodynamic properties.

NOTE For CE marking requirements for information on the product, Clause ZA.3 applies.

12 Assessment and verification of constancy of performance (AVCP)

12.1 General

The compliance of the concrete flue blocks with the requirements of this standard and with the stated values (including classes) shall be demonstrated by:

— initial type testing,

— factory production control by the manufacturer, including product assessment.

12.2 Initial type testing

Type test relating to material composition shall be performed initially together with factory production control tests as given in Table 6. One test shall be carried out for each requirement.

The thermal testing shall be carried out on one size of flue block for each geometrical configuration, e.g. circular, square, rectangular. For circular flue blocks, the size to be tested shall be 200 mm ± 50 mm internal diameter. For other geometrical configurations, the flue block shall have an equivalent cross-sectional area range.

12.3 Further type tests

Type tests shall be performed when a change is made either in material composition, processing technique or to the design or method of manufacture of the flue block, but they may be performed more frequently by incorporation into a plan for monitoring the consistency of manufacture (see Table 6).

Table 6 — Factory production control and type tests

Item	Relevant requirement clauses	
	Factory production control 12.4 [a]	Type tests 12.2 and 12.3
Flue blocks and fittings	4, 5, 6, 7.1, 7.2, 7.3, 8.6, 8.10	4, 5, 6, 7.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8, 8.9, 8.10, 8.11, 8.12, 8.13, 8.16
Terminals	4, 5, 6, 7.1, 7.2, 7.3, 8.6, 8.10	4, 5, 6, 7.1, 7.2, 7.3, 8.1, 8.2, 8.5, 8.6, 8.7, 8.10, 8.11. 8.13. 8.17
[a] The tests carried out during FPC are intended to verify that the performance requirements assessed through the initial type testing are maintained.		

12.4 Factory production control

To achieve compliance with this standard, the manufacturer shall establish and maintain an effective documented quality system.

Factory production control tests are carried out following manufacture to monitor the quality of product (see Table 6).

Sampling and testing of any batch shall be completed prior to removal from the works and shall be in accordance with ISO 2859-1:1999 at an AQL of 10 % and inspection level S2. Isolated batches of units shall be assessed in accordance with tightened inspection procedures, with a maximum batch size of 2 500 (see Annex D).

Batches rejected under the factory production control procedure may be resubmitted once, after removal of units with previously undetected visible defects, under the tightened inspection procedures, in respect only of the defect that caused initial rejection.

NOTE A quality system assessed by a certification body which complies with the requirements of EN ISO/IEC 17021-1 [1] may be applied to ensure that the requirements of EN ISO 9001 [3] and Clause 12 are complied with.

Annex A
(normative)

Test methods

NOTE Annex E gives the recommended test sequence.

A.1 Squareness of ends test

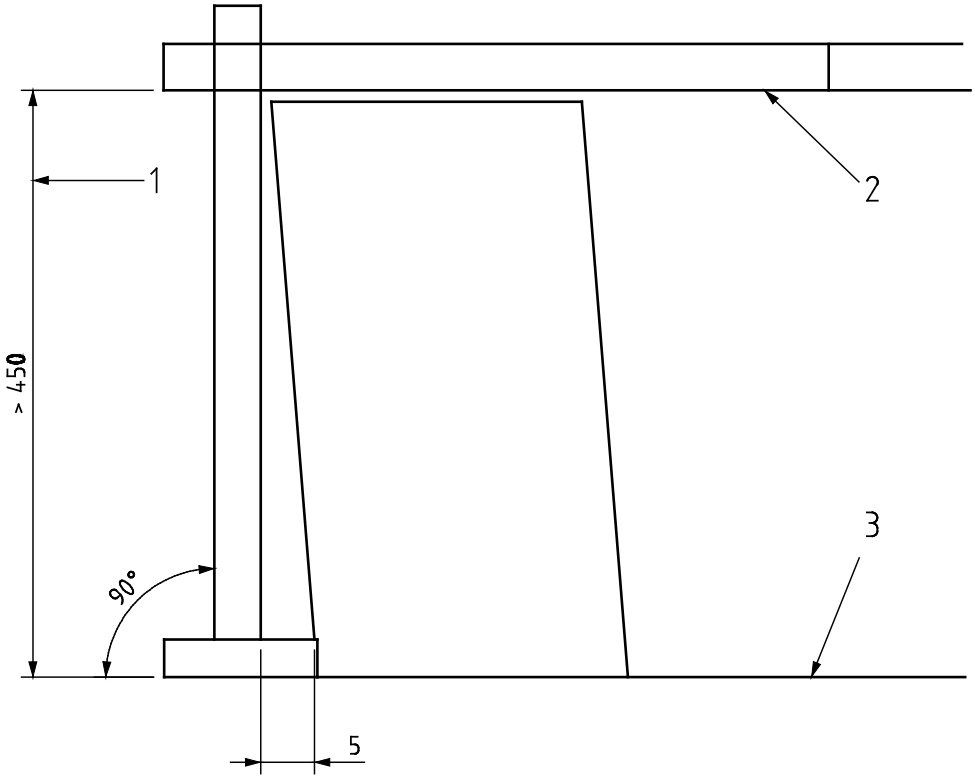
A.1.1 Apparatus

The apparatus shall include the following:

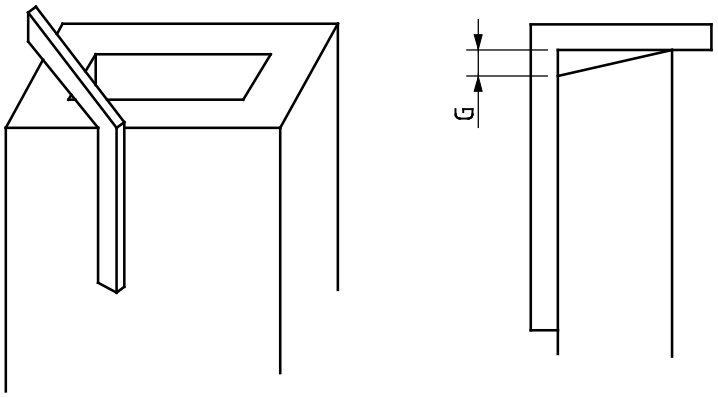
A.1.1.1 A level test bench with a fixed upright at 90°, see Figure A.1 a);

A.1.1.2 A square having one arm 300 mm long and the second arm 400 mm long.

Dimensions in millimetres



a) First procedure



b) Second procedure

Key

1 adjustable

2 adjustable cantilevered straight edge

3 level test surface

5 dimension in mm

G dimension in mm

Figure A.1 — Apparatus for squareness test

A.1.2 First procedure

Place the flue block upright on the test bench with the base of the flue block touching the collar. Rotate the flue block through 360°.

A.1.3 Test result — first procedure

Record any case where the flue block touches the upright.

A.1.4 Second procedure

Place the flue block upright on the test bench and apply one arm of the square along its side with the other arm touching the end of the flue block. Rotate the square across the end of the flue block as shown in Figure A.1 b).

A.1.5 Test result — second procedure

Record any case where the dimension G exceeds 5 mm.

A.2 Straightness test

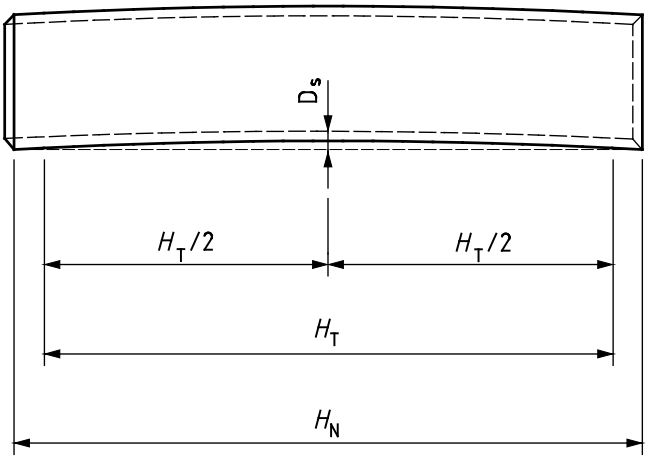
A.2.1 Apparatus

A straightness measuring device, such as a straight edge, having a height 100 mm less than the nominal height of the flue block under test.

A.2.2 Procedure

A.2.2.1 Place the measuring device along the line HT as shown in Figure A.2.

A.2.2.2 Measure the maximum distance from the centre of the straight line created by the apparatus in A.2.1 spanning any concave curve on the outside of the flue block surface (D_S) as shown in Figure A.2.



Key

H_N nominal height of the flue block in mm

H_T test height in mm

D_S deviation from straightness in mm

HN - HT = 100 mm ± 5 mm

Figure A.2 — Straightness test

A.2.3 Test result

Record any case where D_S is greater than 1 % or, in the case of flue blocks equal to or greater than 1 000 mm in height, any case where D_S is greater than 0,5 % of the declared height.

A.3 Thermal performance tests

A.3.1 The thermal performance tests shall be undertaken according to EN 13216-1, using the thermal test procedure for the heat stress resistance, and the thermal shock test procedure for the heat shock resistance.

The test assembly (free standing, corner installation non enclosed, corner installation enclosed) shall be that declared by the manufacturer.

The test chimney shall be constructed according to the manufacturer's installation instructions.

The test chimney of a side-by-side configuration (see Figure B.2) shall be positioned with the flue duct in the corner of the test structure.

For concentric configurations close the air supply duct inlet.

Allow the test sample to cool to ambient without assistance, e.g. without forced ventilation before undertaking the next test.

A.3.2 Subject the test sample to the test described in A.5 and A.6.

A.3.3 Test results

Record the maximum temperature of the test assembly according to EN 13216-1, and either:

a) if the test temperature for the free standing test assembly was used, calculate what the surface temperature of a combustible partition, having a thermal resistance of 0,4 m^2K/W ± 10 % at 100 °C, would have been when separated from the test sample by the specified distance to combustible materials (as declared by the manufacturer); or

b) if the test assembly is a corner installation non enclosed or a corner installation enclosed, record the maximum surface temperature of the combustible partition.

Record the leakage rate of the flue duct and air supply duct of the test sample.

Record the weight of any material that has been dislodged from the internal surface of the flue duct of the test assembly.

NOTE 1 A method for calculating the surface temperature of adjacent combustible material is given in EN 15287–1 [2].

NOTE 2 The specified distance to combustibles may be specified in local regulations.

A.4 Thermal resistance

A.4.1 Test Method

Thermal resistance shall be determined according to the test method of EN 13216-1 using a flue gas temperature of 200°C.

The test sample shall be the flue duct.

A.4.2 Test results

Record the thermal resistance of the flue duct.

A.5 Gas tightness test

A.5.1 Test Method

Gas tightness shall be measured according to the test method of EN 13216-1 before and after the thermal performance tests.

Ensure that the test sample has been conditioned for a minimum of 28 days at ambient temperature unless otherwise specified by the manufacturer.

A.5.2 Test result

Calculate the leakage rate, E of the assembly, expressed in l $m^{-2} \cdot s^{-1}$, using the equation

$$E = \frac{Q}{S \cdot t}$$

where

Q is the air volume passing through the test assembly during test, in litres;

S is the inside surface area of the flue block, in m^2;

t is the test duration, in s.

A.6 Abrasion resistance test

A.6.1 Test Method

The abrasion resistance test shall be undertaken according to EN 13216-1 on the flue duct.

The test sample shall be constructed according to the manufacture's installation instructions.

Discard the material dislodged during the first 20 cycles. Continue the test for a further 80 cycles and collect the material dislodged.

A.6.2 Test result

Record the weight of any material that has been dislodged from the internal surface of the test assembly and calculate the total area of the internal surface of the flue between the sleeves.

A.7 Compressive strength test

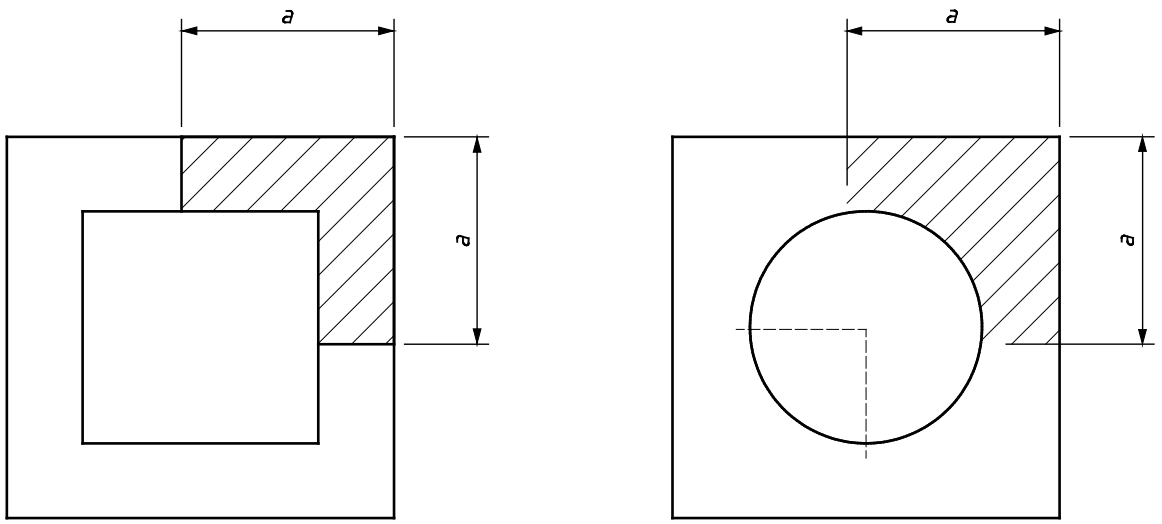
A.7.1 Apparatus

A machine having a verified accuracy as specified in EN ISO 7500-1:2015, Class 3, capable of applying the test load at the rate specified in A.7.3.

A.7.2 Preparation of test sample

A.7.2.1 Prepare a section of flue block at least 150 mm in height or one complete flue block height if shorter than 150 mm, by sawing each end to produce flat and parallel ends, to within the tolerances specified in 7.3, square to the axis. For flue blocks having external transverse dimensions greater than 300 mm, cut by sawing a section as indicated in Figure A.3, and saw the upper and lower ends to produce flat and parallel ends, square to the axis.

For a concentric flue block the test shall be performed separately on both the flue duct and the air supply duct.



a) parallelepiped flue block **b) cylindrical flue block**

Figure A.3 — Compressive strength sample

A.7.2.2 Determine by calculation, the gross sectional area of the section and the position of the vertical axis of the centre of gravity of the test sample.

A.7.2.3 Prepare the ends of the sample with cement mortar (1 part calcium aluminate cement and 2 parts ordinary Portland cement) to achieve flat and parallel ends, square to the axis. Allow 24 h to harden or more if specified by the manufacturer.

A.7.2.4 Place sample between the test plates so that the axis of the plates corresponds with the axis of the centre of gravity of the test sample, with a limit deviation of 1 mm.

A.7.3 Test procedure

Apply a load without shock to the test sample and increase at a rate of 0,3 MPa/s ± 0,05 MPa/s until the required load as specified in 8.6 is reached.

A.7.4 Test result

Record whether the load in 8.6 was reached.

A.8 Corrosion and condensate resistance test

A.8.1 Test apparatus

A.8.1.1 An upper tank containing an acid test solution (see A.8.2), connected by means of a pipe and gate valve to a lower tank (see Figure A.4).

A.8.1.2 A lower tank containing:

a) an electrical heating element immersed in test solution;

b) a thermometer (T) to measure temperature of test solution;

c) a gauge (L) to measure the level of test solution;

d) a mechanical stirrer (S) to agitate the test solution;

e) a gauge (pH) to measure pH of the test solution;

f) a collection collar.

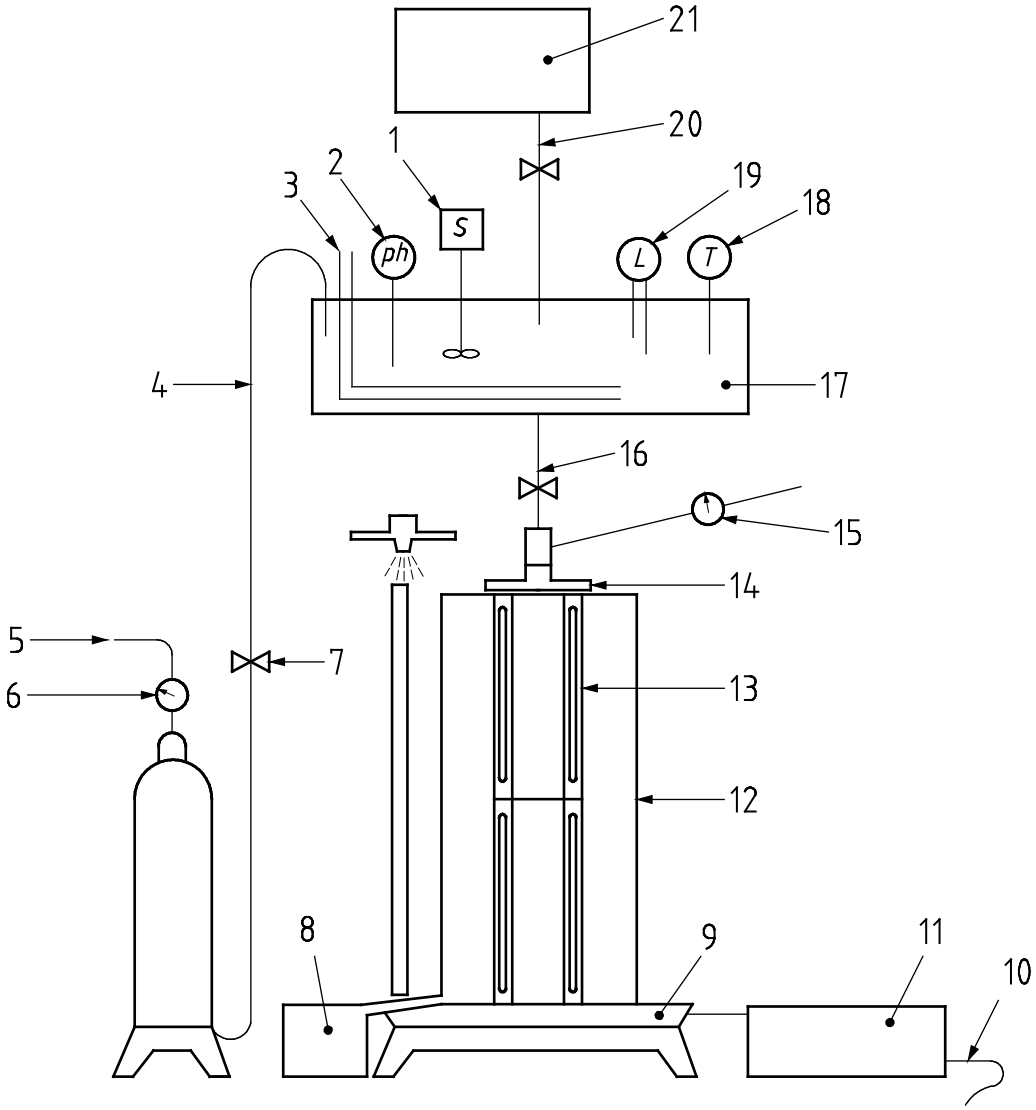
A.8.1.3 A spray nozzle connected by means of a pipe and gate valve to the lower tank, with the nozzle passing an air-tight cap closing off the top of the flue blank under test.

A.8.1.4 A pressurized air supply connected to the spray nozzle fitted with a pressure gauge to regulate the air pressure.

A.8.1.5 A controlled supply of pressurized de-ionized water feeding into the lower tank.

A.8.1.6 A collection tray, fitted with a grid, connected to a holding tank to allow safe removal of the used test solution.

A.8.1.7 An air-tight vessel providing an annulus of 75 mm ± 10 mm around the flue block under test.



Key

1	mechanical stirrer	12	air-tight cylinder
2	gauge for measuring pH value	13	flue block test assembly
3	electrical heating elements	14	air-tight cap
4	pipe supplying de-ionized water	15	air supply pipe with pressure gauge controlling air supply to spray nozzle
5	water supply pipe	16	pipe with gate valve supplying test solution to spray nozzle
6	pressure gauge	17	lower tank containing test solution
7	gate valve	18	thermometer for measuring temperature of test solution
8	holding tank for collecting test solution having passed through flue block test assembly walls	19	gauges for measuring level of test solution
9	collection tray for used test solution	20	pipe
10	pipe for removal of used test solution	21	upper tank containing acid solution
11	holding tank for used test solution		

Figure A.4 — Corrosion test apparatus

A.8.2 Acid solution and test solution

The acid solution in the upper tank (Figure A.4, item 21) for W1 conditions shall have the following composition:

$(SO)^{2-}$ = 40 mg/l;

$(NO)^{2-}$ = 26 mg/l;

$(Cl)^{1-}$ = 5 mg/l.

The test solution in the lower tank (Figure A.4, item 17) shall be adjusted to a pH of 3,5 ± 0,2 by the addition of either acid solution or deionised water.

The acid solution in the upper tank (Figure A.4, item 21) for W2 conditions shall have the following composition:

$(SO)^{2-}$ = 250 mg/l;

$(NO)^{2-}$ = 80 mg/l;

$(Cl)^{1-}$ = 10 mg/l.

The test solution in the lower tank (Figure A.4, item 17) shall be adjusted to a pH of 2,3 ± 0,2 by the addition of either acid solution or deionised water.

A.8.3 Test sample

Join two flue blocks, which have been subjected to the heat stress to their appropriate temperature group designation (for temperature designations greater than T200), having internal transverse dimensions of

140 mm ± 10 mm or the nearest size in the manufacturer's range, in accordance with the manufacturer's installation instructions.

If the flue block is of multiwall construction, with a separate concrete flue liner, carry out the test on the flue liner only.

A.8.4 Conditioning

Store the test assembly in a closed and ventilated room for 7 days or dry in an oven at 70 °C ± 5 °C until constant weight is achieved.

A.8.5 Test procedure

After conditioning, record the weight of the test assembly (A.8.3), fit and seal the air-tight vessel around the flue block and then position it on the collection tray (A.8.1.6) directly under the spray nozzle and cap (A.8.1.3) as shown in Figure A.4.

Pass the test solution (A.8.2) at a pressure of (0,3 ± 0,03) MPa at a temperature of (50 ± 5) °C through the spray nozzle (A.8.1.3) onto the inside face of the test section at a rate of 18 l/h ± 2 l/h and maintain for (15 ± 2) min.

After the spraying cycle dry the test assembly, by blowing dry air at a pressure of (0,3 ± 0,03) MPa and temperature of (20 ± 5) °C through the test assembly for (15 ± 2) min. Every 24^{+2}_{0} h weigh any solution collected at the base of the vessel.

Repeat the spraying and drying cycle 240 times, then wash out the inside of the test section by spraying clean water for a period of 30^{+2}_{0} min at a pressure of (0,3 ± 0,03) MPa. Then condition the test section as described in A.8.4. Record the weight of test assembly. Maintain the temperature of the test room at (20 ± 5) °C throughout the test.

A.8.6 Test results

A.8.6.1 Compare the first recorded weight with the final weight after testing and record any change in weight.

A.8.6.2 Record the mass of any solution collected at the base of the vessel of each reading during the test and calculate the flow of solution expressed in gh-1m-2 of external surface of the flue block.

A.9 Water vapour diffusion resistance

A.9.1 Test method

The water vapour diffusion resistance test shall be undertaken according to the water vapour diffusion resistance test of EN 13216-1.

A.9.2 Test results

Record the location of any appearance of water on the outside of any fitting or chimney section of the test chimney.

Record any change in the weight of the test sample.

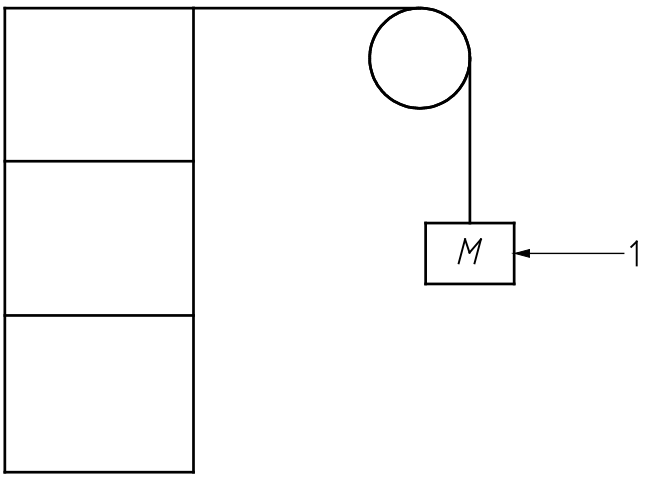
Record any change in humidity and temperature within the boundary layer between insulation and outer wall.

A.10 Flexural strength under wind load

A.10.1 Principle

The flexural strength under wind load is determined by measuring the tilt momentum of a chimney top under a horizontal load (see Figure A.5).

NOTE The flexural strength under wind load can be used to work out the maximum height above the roof (free standing part of the chimney outside the building) in accordance with national regulations.



Key

1 tilt-load, M

Figure A.5 — Example of wind load test arrangement

A.10.2 Preparation of test specimen

The test shall be carried out with an assembly, consisting of the manufacturer's declared components (e.g. single wall or multi wall flue blocks) at least 1 m in height and with at least one joint. The flue blocks shall be jointed according to manufacturer's instructions.

Where a terminal is fitted to the flue block repeat the test separately for the terminal

Carry out the test on three different geometrical sizes (small, medium, large), in accordance with the dimensional range of the chimney system.

A.10.3 Test procedure

Fit the components together on the floor. Anchor the lower section. Put a steel frame on the top of the test section. Apply a horizontal load on the frame, increase the load until the top section tilts.

A.10.4 Test result

Record the measured tilt-load *m* in kN.

A.11 Bulk density

A.11.1 Apparatus

A.11.1.1 Callipers, graduated in 0,5 mm, or flat metal rule, graduated in 0,5 mm and having a square at one end which can be fitted to the edge of the test piece.

A.11.1.2 Drying oven, capable of being controlled at 70 °C ± 5 °C.

A.11.1.3 Balance, with an error limit of ± 0,1 g.

A.11.1.4 Desiccator

A.11.2 Procedure

A.11.2.1 Cut three nominally rectangular test pieces each having a volume not less than 500 cm^3 from three separate units from each type of concrete used in the chimney. Cut the first test piece from the upper portion of one unit, the second test piece from the middle portion of the second unit and a third piece from the lower portion of a third unit.

The lower portion of the third unit is that towards the end opposite from the end from which the first test piece has been taken, to take account of any material variance that may occur during manufacture.

For multiwall products, test the liner and outer wall separately.

A.11.2.2 Using the callipers or flat metal rule, measure the three principal dimensions (length *l*, breadth *b* and thickness *d*) of each test piece to within 1 mm. Make these measurements at the centre line of each face (i.e. four times for each dimension) and note the average of the four measurements for each of the three dimensions.

A.11.2.3 Dry the test piece in the drying oven for 48 h_0^{30} min, +controlled at 70 °C ± 5 °C, then remove and allow to cool to ambient temperature in the desiccator. Weigh each piece to the nearest 1 g.

A.11.3 Test result

A.11.3.1 Calculate and record the bulk volume and bulk density values for each test piece and the average values for the three pieces.

Calculate and express the results in accordance with A.11.3.2, A.11.3.3 and A.11.3.4.

A.11.3.2 Calculate the bulk volume Vb of the test piece, in cubic centimetres, using the equation

$$V_b = l \cdot b \cdot d$$

where

l is the length of the test piece, in cm;

b is the breadth of the test piece, in cm;

d is the thickness of the test piece, in cm.

A.11.3.3 Calculate the bulk density Q_b of the test piece, in kilograms per cubic metre, using the equation

$$Q_b = \frac{m}{V_b} \cdot 10^3 \qquad \text{(A.1)}$$

where

m is the dry mass, in grams (g);

V_b is the bulk volume, in cubic centimetres (cm^3).

A.11.3.4 Express the bulk density in kilograms per cubic metre to three significant figures.

A.12 Ultimate compressive strength

A.12.1 Test procedure

Using the apparatus specified in A.7.1 and a sample specified in A.7.2, apply a load, without shock and increase at a rate of 0,3 MPa/s ± 0,05 MPa/s until no further load can be applied (until the sample fractures).

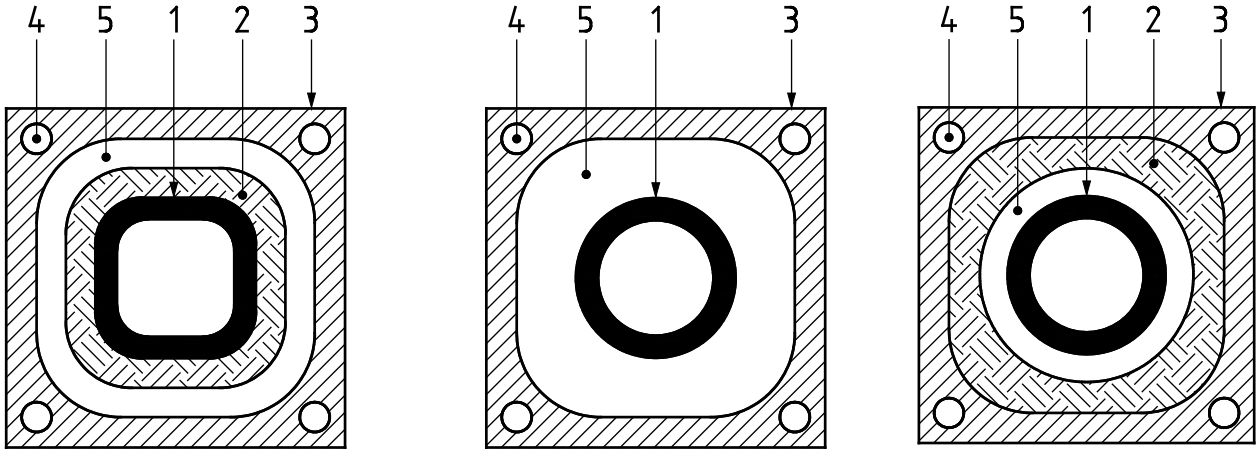
A.12.2 Test result

Record the maximum load.

Annex B
(informative)

Examples of concrete flue block shapes

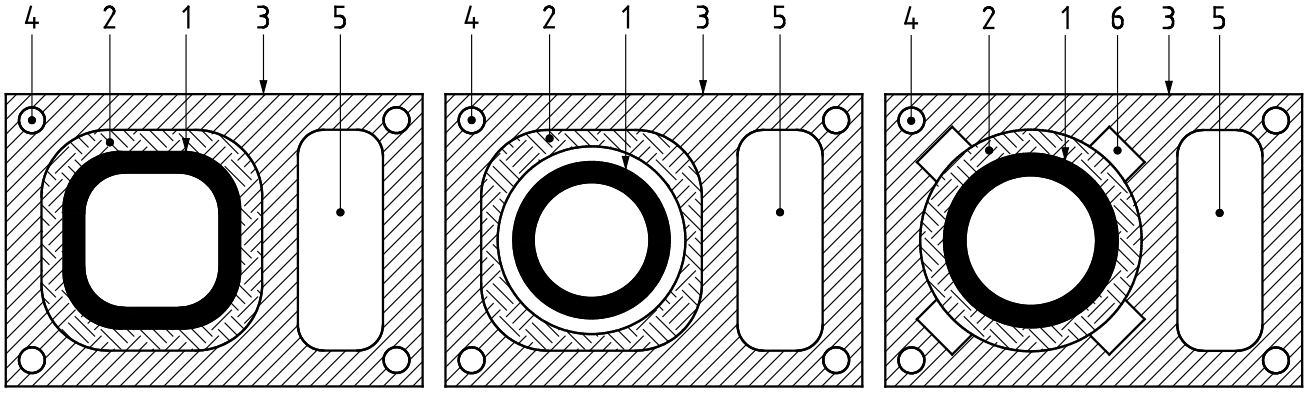
B.1 General



Key

1 flue duct
2 insulation layer
3 outer wall
4 cavities for e.g. reinforcement
5 air gap

Figure B.1 — Examples of cross sections of concentric air flue system chimneys



Key

1 flue duct

2 insulation layer or air gap

3 outer wall

4 cavities

5 air duct

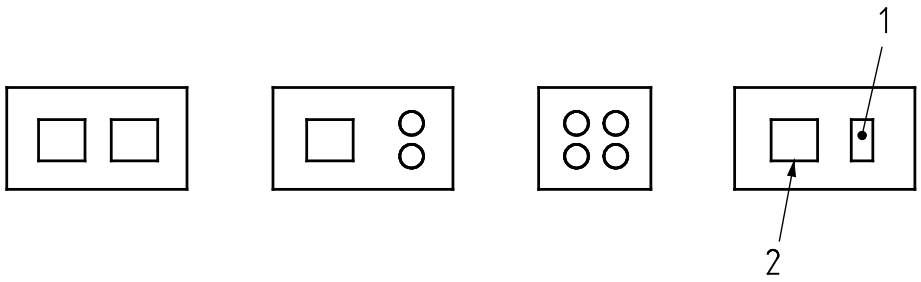
6 cavities

Figure B.2 — Examples of cross sections of side-by-side air flue system chimneys

B.2 Multi-flued flue blocks

Plan views of multi-flued flue blocks, which may have solid or hollow walls, are shown in Figure B.3. The maximum number of flues or ventilation passages in a block is 4 (see Clause 4).

The passages may be of different sizes. Example of flue block with flue and ventilation passage is shown on Figure B.3.



Key

1 flue

2 combustion air supply passage

Figure B.3 — Multi-flued flue blocks

Annex C
(normative)

Thermal resistance calculation method

C.1 Thermal resistance of the individual element

The calculation method shall be validated to give results within ± 10 % of the reference method (see A.4).

For calculation of the thermal resistance of the element, the temperature of the flue gas shall be taken to be equal to 200 °C and the value of $\alpha 1$ shall be equal to 17 W/m °C and α 2 equal to 11 W/m °C.

NOTE The values of α have been determined as conventional values for a temperature of the flue gas of 200 °C with a flow of 5 m/s and a temperature of the outside face of up to 50 °C.

C.2 Thermal resistance of the chimney and of enclosures

If the specific material properties and layer thickness are known, determine the thermal resistance, *R*, in $m^2 \cdot K \cdot W^{-1}$ approximately in accordance with the following equations:

a) with knowledge of the thermal resistance of the individual element:

$$R = D_h \sum \frac{h}{2\lambda_n} \ln\left\{\frac{D}{D_{h,n}}\right\} \quad \text{(C.1)}$$

b) with knowledge of the coefficients of thermal conductivity of layers:

$$R = y \sum \frac{h}{2\lambda_n} \ln\left\{\frac{D}{D_{h,n}}\right\} \quad \text{(C.2)}$$

where

R_n is the thermal resistance of an individual element, n, in $m^2 \cdot K \cdot W^{-1}$;

Y is the coefficient of form:

1,0 for round and oval cross-sections,

1,10 for square and rectangular cross-sections up to a ratio of a side of 1:1,5;

D_h is the internal hydraulic diameter in metres (m);

$D_{h,n}$ is the hydraulic diameter of the inside of each layer in metres (m);

λ_n is the coefficient of thermal conductivity of the material of the layer at operation temperature in W/(mK).

Annex D
(normative)

Requirements of sampling plan according to ISO 2859-1:1999 at an Acceptable Quality Level (AQL) of 10 % and inspection level S2

D.1 Acceptability determination

NOTE Single or double sampling may be used.

D.1.1 Single sampling

If the number of defectives found in the sample is equal to or less than the acceptance number, the batch shall be accepted. If the number of defectives is equal to or greater than the rejection number, the batch shall be rejected.

When reduced inspection is in effect and the acceptance number has been exceeded, but the rejection number has not been reached, the batch shall be accepted and normal inspection reinstated. If the rejection number has been reached or exceeded, the batch shall be rejected and normal inspection reinstated.

D.1.2 Double sampling

The number of sample units shall be equal to the first sample size in the plan. If the number of defectives found in the first sample is equal to or less than the first acceptance number, the batch shall be accepted. If the number of defectives found in the first sample is equal to or greater than the first rejection number, the batch shall be rejected. If the number of defectives found in the first sample is between the first acceptance and rejection numbers, the second sample of the size given in the plan shall be inspected.

The number of defectives found in the first and second samples shall be accumulated. If the cumulative number of defectives is equal to or less than the second acceptance number, the batch shall be accepted. If the cumulative number of defectives is equal to or greater than the second rejection number, the batch shall be rejected. If this occurs on reduced inspection, normal inspection shall be reinstated for the next batch.

When reduced inspection is in effect and, after the second sample, the acceptance number has been exceeded but the rejection number has not yet been reached, the batch shall be accepted and normal inspection reinstated.

D.2 Normal inspection

The sample size appropriate to the batch size and the acceptance and rejection values for numbers of defectives shall be in accordance with Table D.1. Sample units shall be selected at random.

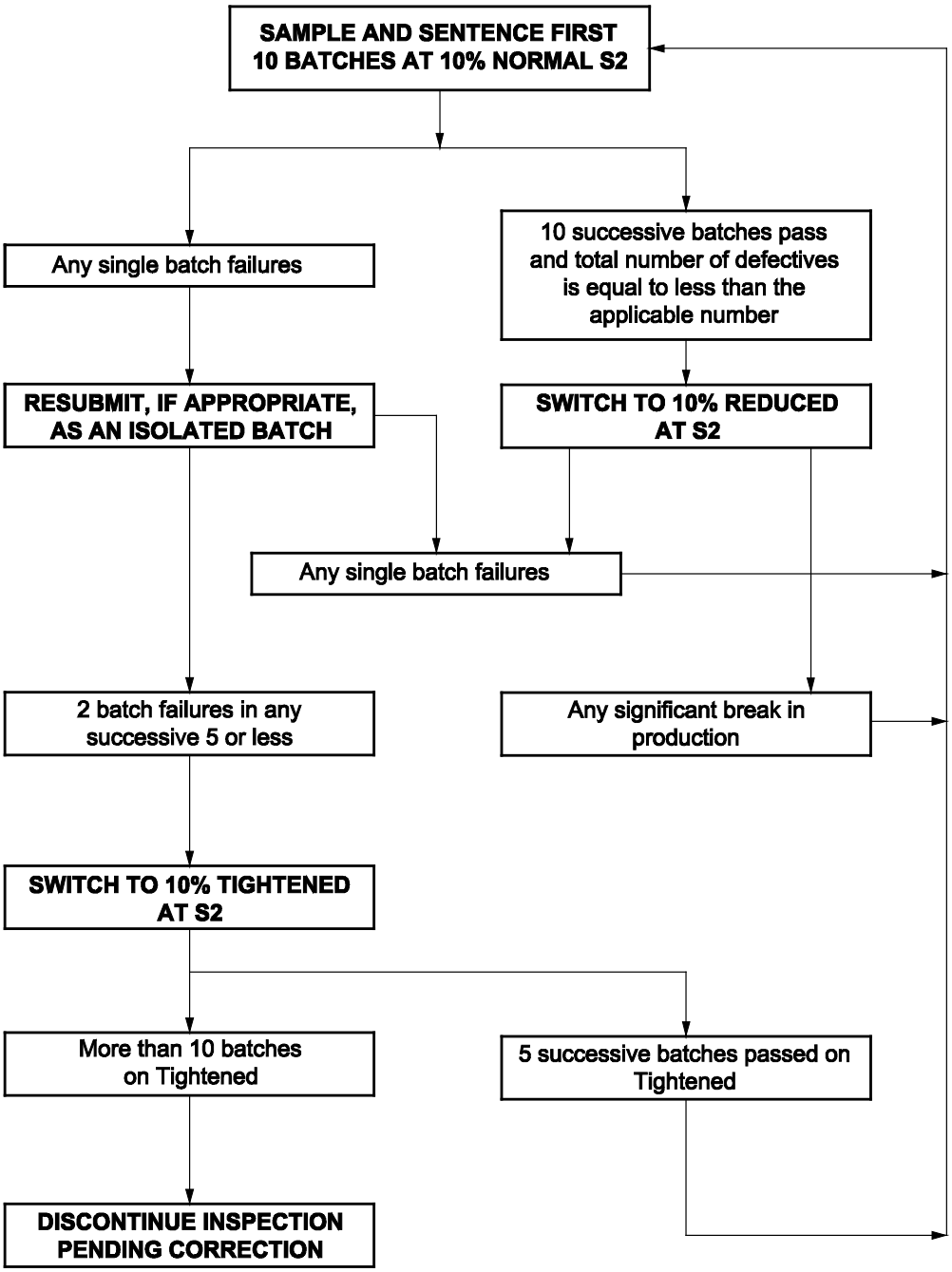


Figure D.1 — Summary of sampling procedures (Continuous batches)

Table D.1 — Sampling plans for normal inspection

Batch size	Single sampling			Double sampling					
	Sample size	Accept number	Reject number	First sample size	Accept number	Reject number	Second sample number	Accept number	Reject number
2 to 1 200	5	1	2	3	0	2	3	1	2
1 201 to 20 000	8	2	3	5	0	3	5	3	4

D.3 Reduced Inspection

A reduced inspection level as shown in Table D.2 shall be used when normal inspection is in effect, provided that the following conditions are satisfied:

a) the preceding ten batches have been on normal inspection, and none has been rejected on original inspection;

b) the total number of defectives in the samples from the ten preceding batches (or such other number required by Table D.3) is equal to or less than the limit number given in Table D.1.

When double sampling is in use, all samples inspected should be included, not first samples only.

Table D.2 — Sampling plans for reduced inspection

Batch size	Single sampling			Double sampling					
	Sample size	Accept number	Reject number	First sample size	Accept number	Reject number	Second sample number	Accept number	Reject number
2 to 1 200	2	0	2	not applicable					
1 201 to 20 000	3	1	3	2	0	3	2	0	4

Table D.3 — Limit number of defectives for normal to reduced inspection

Number of samples from last ten batches	Limit number of defectives
20 to 29	0
30 to 49	0
50 to 79	2
80 to 129	4

D.4 Reduced to normal inspection

When reduced inspection is in effect, normal inspection shall be reinstated if a batch is rejected, or if a batch is accepted without either acceptance or rejection criteria having been made (see D.1.1 and D.1.2).

D.5 Tightened inspection

Tightened inspection as shown in Table D.4 shall be used either when inspecting a new product or when two or more batches have been rejected in any five consecutive batches of normal inspection or for inspecting a batch which has previously been rejected after removal of units with previously undetected visible defects.

Table D.4 — Sampling plans for tightened inspection

Batch size	**Single sampling**			**Double sampling**					
	Sample size	Accept number	Reject number	First sample size	Accept number	Reject number	Second sample number	Accept number	Reject number
8 to 20 000	8	1	2	5	0	2	5	1	2

D.6 Tightened to normal inspection

Tightened inspection shall continue until five consecutive batches are accepted when normal inspection shall be resumed.

D.7 Discontinuation of inspection

If ten consecutive batches remain on tightened inspection, the provision of these sampling plans shall be discontinued pending action to improve the quality of the submitted batches.

Annex E
(informative)

Recommended test sequence for performance characteristics

The following performance test sequence is recommended:

1) gas tightness;
2) abrasion resistance;
3) heat stress test at nominal working temperature;
4) gas tightness;
5) abrasion resistance;
6) relative movement
7) thermal shock;
8) gas tightness;
9) abrasion resistance;
10) relative movement
11) compressive strength
12) Flexural strength
13) Flow resistance
14) freeze thaw

And where appropriate:-

15) corrosion/condensate resistance
16) Water vapour diffusion resistance
17) Terminal characteristics

Annex ZA
(informative)

Relationship of this European Standard with Regulation (EU) No.305/2011

(When applying this standard as a harmonized standard under Regulation (EU) No. 305/2011, manufacturers and Member States are obliged by this regulation to use this Annex)

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under standardization request M/105 'Chimneys, flues and specific products', the horizontal Mandate M/117 and its subsequent revisions given to CEN and CENELEC by the European Commission (EC) and the European Free Trade Association (EFTA).

When this European Standard is cited in the Official Journal of the European Union (OJEU), under Regulation (EU) No 305/2011, it shall be possible to use it as a basis for the establishment of the Declaration of Performance (DoP) and the CE marking, from the date of the beginning of the co-existence period as specified in the OJEU.

Regulation (EU) No 305/2011, as amended, contains provisions for the DoP and the CE marking.

Table ZA.1.1 — Relevant clauses for concrete system chimney for balanced flue applications

Product: Concrete system chimneys **Intended use:** conveying products of combustion from heating appliances to the outside atmosphere and convey combustion air to appliances from the outside atmosphere in balanced flue applications			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Gas tightness/leakage	8.4 Gas tightness	-	Declared pressure class
Flow resistance	8.12.1 Flow resistance of straight flue ducts	-	Declared mean roughness (in metres)
	8.12.2 Flow resistance of straight air supply ducts	-	Declared mean roughness (in metres)
	8.12.3 Flow resistance of fittings	-	Declared coefficient of flow resistance
Thermal resistance	8.3 Thermal resistance of the flue duct	-	Declared value of thermal resistance
Resistance to fire internal to external	8.1 Heat stress resistance	-	Declared Non sootfire resistant product class O xx
	8.2 Heat shock resistance	-	Declared Sootfire resistant product

Product: Concrete system chimneys **Intended use:** conveying products of combustion from heating appliances to the outside atmosphere and convey combustion air to appliances from the outside atmosphere in balanced flue applications			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
			class G xx
Resistance to fire external to external	8.14 Resistance to fire external to external	-	As declared
Reaction to fire	5.2 Reaction to fire	A1 to F	Declared class
Compressive strength	8.6 Compressive strength	-	Declared structural height
Flexural strength	8.11 Flexural strength under wind loading	-	Declared maximum unsupported height
Durability: chemicals	8.8 Condensate resistance 8.9 Water vapour diffusion resistance	-	Declared condensate resistance class (subject to a threshold value for class W products)
Durability: corrosion	8.7 Corrosion resistance	-	Declared corrosion resistance class (subject to a threshold value for class W products)
Durability: Abrasion	8.5 Abrasion resistance	-	Declared abrasion resistant subject to a threshold value
Durability: resistance to freeze–thaw	8.13 Freeze–thaw resistance	-	Declared freeze thaw resistant
Dangerous substances	8.15 Dangerous substances	-	As indicated in ZA.1 and ZA.3

Table ZA.1.2 — Relevant clauses for terminals for concrete system chimney for balanced flue applications

Product: terminals for concrete system chimneys **Intended use:** conveying products of combustion from heating appliances to the outside atmosphere and convey combustion air to appliances from the outside atmosphere for balanced flue applications			
Essential Characteristics	**Clauses in this and other European Standard(s) related to essential characteristics**	**Regulatory classes**	**Notes**
Flow resistance	8.17.2	-	Declared coefficient

ZA.2 System of Assessment and Verification of Constancy of Performance (AVCP)

The AVCP systems of concrete system chimneys and terminals indicated in Tables ZA.1.1 to ZA.1.2, can be found in the EC legal act(s) adopted by the EC: Decisions 95/467/EC (OJ l 268 of 10.11.1995), adopted by the EC] [2001/596/EC of 8 January 2001 (L209) and 2002/592/EC of 15 July 2002 and 2010/679/EU of 8 November 2010 (L292)]

Micro-enterprises are allowed to treat products under AVCP system 3 covered by this standard in accordance with AVCP system 4, applying this simplified procedure with its conditions, as foreseen in Article 37 of Regulation (EU) No.305/2011.

ZA.3 Assignment of AVCP tasks

The AVCP systems of concrete system chimneys and terminals as provided in Tables ZA.1.1 to ZA.1.2 is defined in Table(s) ZA.3.1 to ZA.3.2 resulting from application of the clauses of this or other European Standards indicated therein. The content of the tasks assigned to the notified body shall be limited to those essential characteristics, if any, as provided for in Annex III of the relevant standardization request and to those that the manufacturer intends to declare.

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer and the notified body respectively for the assessment and verification of the constancy of performance of the product.

Table ZA.3.1 — Assignment of AVCP tasks for concrete system chimneys in balanced flue applications under system 2+

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	12.4 and Annex D
	Determination of the product-type on the basis of type testing (including sampling), type calculation, tabulated values or descriptive documentation of the product	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use which are declared	12.2
	Further testing of samples taken at factory according to the prescribed test plan	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	12.3
Tasks for the notified production control certification body	Initial inspection of the manufacturing plant and of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared. Documentation of the FPC.	12.4, and Annex D
	Continuous surveillance, assessment and evaluation of FPC	Parameters related to essential characteristics of Table ZA.1, relevant for the intended use which are declared. Documentation of the FPC.	12.4, and Annex D

Table ZA.3.2 — Assignment of AVCP tasks for terminals in concrete system chimneys in balanced flue applications under system 4

Tasks		Content of the task	AVCP clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to essential characteristics of Table ZA.1 relevant for the intended use	12.4 and Annex D
	Determination of the product-type on the basis of type testing, type calculation, tabulated values or descriptive documentation of the product	Essential characteristics of Table ZA.1 relevant for the intended use which are declared	12.2 and 12.3

Taking into account the AVCP systems defined for the products and the intended uses the following tasks are to be undertaken by the manufacturer for the assessment and verification of the constancy of performance of the product.

Bibliography

[1] EN ISO/IEC 17021-1, *Conformity assessment — Requirements for bodies providing audit and certification of management systems — Part 1: Requirements (ISO/IEC 17021-1)*

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[3] EN ISO 9001, *Quality management systems — Requirements (ISO 9001)*

[4] EN 13501-1, *Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests*

[5] EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

[6] Council Directive 89/106/EEC "Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products"

[7] *Guidance Paper E "Levels and classes in the Construction Products Directive"*

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