BS EN 12446:2011

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Chimneys — Components — Concrete outer wall elements

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National foreword

This British Standard is the UK implementation of EN 12446:2011. It supersedes BS EN 12446:2003 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/506, Chimneys.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Abgasanlagen - Bauteile - Außenschalen aus Beton

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Contents

Page

Foreword 4

1 Scope 5

2 Normative references 5

3 Terms and definitions 5

4 Materials 7
4.1 General 7
4.2 Reaction to fire 7

5 Reinforcement for handling 7

6 Surface treatment 7

7 Form, dimensions and tolerances 8
7.1 Form 8
7.2 Dimensions 8
7.3 Tolerances 8
7.4 Squareness of ends 8

8 Performance 9
8.1 Heat stress resistance 9
8.2 Heat shock resistance 10
8.3 Thermal resistance 10
8.4 Compressive strength 10
8.5 Bulk density 10
8.6 Freeze-thaw resistance 10
8.7 Flexural strength under wind loading 11
8.8 Gas tightness of passages used for combustion air 11
8.9 Resistance to fire external to external 11
8.10 Dangerous substances 11

9 Designation 12
9.1 Designations and classes 12
9.2 Temperature classes 12
9.3 Pressure class application 12
9.4 Soot fire resistance class 12
9.5 Distance to combustible materials 12
9.6 Manufacturer's information class 13

10 Marking 13

11 Product information 13

12 Evaluation of conformity 14
12.1 General 14
12.2 Initial type testing 14
12.3 Further type tests 14
12.4 Factory production control 14

Annex A (normative) **Test methods** 16
Heat stress resistance and heat shock test 16
A.1 16
Apparatus 16
A.1.1 16
A.1.2 Test assembly 16

A.1.3 Test environment and conditioning **19**
A.1.4 Procedure **20**
A.1.5 Test results **21**
A.2 Flexural strength under wind load **21**
A.2.1 Principle **21**
A.2.2 Preparation of test specimen **21**
A.2.3 Test procedure **21**
A.3 Gas tightness test **22**
A.3.1 Apparatus **22**
A.3.2 Test environment and conditioning **22**
A.3.3 Procedure **22**
A.3.4 Result **23**

Annex B (normative) **Requirements of sampling plan according to ISO 2859-1 at an Acceptable Quality Level (AQL) and inspection level S2 Inspection Procedure** **24**
B.1 Acceptability determination **24**
B.1.1 General **24**
B.1.2 Single sampling **24**
B.1.3 Double sampling **24**
B.2 Normal inspection **24**
B.3 Reduced Inspection **26**
B.4 Reduced to normal inspection **26**
B.5 Tightened inspection **26**
B.6 Tightened to normal inspection **27**
B.7 Discontinuation of inspection **27**

Annex ZA (informative) **Clauses of this European Standard addressing the provisions of the EU Construction Products Directive** **28**
ZA.1 Scope and relevant characteristics **28**
ZA.2 Procedure of attestation of conformity of concrete outer wall elements **29**
ZA.2.1 System of attestation of conformity **29**
ZA.2.2 EC Certificate and Declaration of conformity **31**
ZA.3 CE Marking and labelling **31**

Bibliography **34**

Foreword

This document (EN 12446:2011) 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 December 2011, and conflicting national standards shall be withdrawn at the latest by March 2013.

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 supersedes EN 12446:2003. The main modifications to EN 12446:2003 are:

a) a revised table of heat flow values for thermal performance testing which now includes values for high pressure applications, e.g. diesel generators,

b) a test method for the evaluation of Flexural strength under wind loading (clause 8.7 and Test methods clause A.2),

c) a requirement to evaluate the gas tightness of passages used for combustion air (clause 8.8 and Test methods clause A.3),

d) a requirement relating to the Resistance to fire from an external source (clause 8.9),

e) a requirement relating to the Release of dangerous substances (clause 8.10).

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 Directive(s) 89/106/EEC, 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, testing and installation 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*

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This European Standard specifies the material, dimensional and performance requirements for factory made precast concrete outer wall elements for chimneys including outer wall fittings.

This European Standard covers elements having up to four passages designated to accommodate a combination of flue liners and/or ventilation passages.

This European Standard also relates to storey-height and reinforced outer wall elements.

This European Standard does not apply to structurally independent (freestanding or self-supporting) chimneys constructed using these outer wall elements.

NOTE Any reference to the term "outer wall element" implies both the outer wall elements and their fittings, except where otherwise indicated.

2 Normative references

The following referenced documents are indispensable for the application of this document. 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 1857:2010, *Chimneys — Components — Concrete flue liners*

EN 1858:2008, *Chimneys — Components — Concrete flue blocks*

EN 10088-2:2005, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes*

EN 10218-2, *Steel wire and wire products — General — Part 2: Wire dimensions and tolerances*

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

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
outer wall fitting
outer wall element such as access openings, offsets

3.2
concrete
material formed by mixing cement, coarse and fine aggregate and water and with or without the incorporation of admixtures, additions, glass fibres or steel fibres, which develops its properties by hydration of the cement

[EN 206-1:2000]

3.3
outer wall element
chimney component that surrounds a flue liner to form the outer wall of a chimney

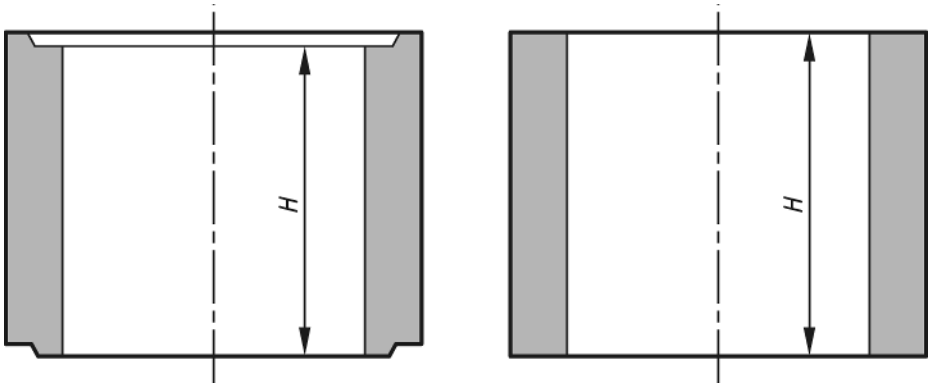
3.4
hollow wall outer wall element
outer wall element having vertical cavities

NOTE Cavities can pass through both ends of the hollow wall outer wall element.

3.5
manufacturer's declared internal transverse dimensions
internal dimensions of the outer wall element measured perpendicular to the longitudinal axis

3.6
manufacturer's declared height
internal height of the outer wall element

NOTE Examples of measurement are shown in Figure 1.



Key

H Internal height

Figure 1 — Internal height

3.7
manufacturer's declared structural height
maximum safe constructional height of the outer wall elements as declared by the manufacturer

3.8
manufacturer's declared overall wall thickness
dimensions at its thinnest point, between the inside face and the outside face of the outer wall element, not measured at any joint feature, e.g. spigot/socket end

3.9
outer wall element with handling reinforcement
outer wall element having steel reinforcement to assist handling and transportation

3.10
solid wall outer wall element
outer wall element without cavities in the thickness of its walls

3.11
straight outer wall element
outer wall element having the ends perpendicular to the axis of the flue

3.12
storey-height outer wall element
factory made outer wall element having an overall height relating to the floor to floor height of a building

3.13
precast concrete
concrete that is cast in a place other than its final location of use

[EN 1858:2008]

4 Materials

4.1 General

Outer wall elements shall be made of pre-cast concrete. Materials shall be identified for factory production control purposes.

NOTE Additions can include glass or steel fibres.

4.2 Reaction to fire

Attention is drawn to the Commission Decision 96/603/EC, as amended, in which non-combustible masonry units containing not more than 1 % by mass or volume (whichever is the more onerous) of homogeneously distributed organic materials are classified as reaction to fire class A1 without testing.

5 Reinforcement for handling

Where an outer wall 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 T 250 and 20 mm on all sides for all other temperature classes.

In outer wall elements having a bulk density of less than 2 000 kg/m^3, when measured according to A.10 of EN 1857:2010, any reinforcement shall be protected against corrosion by one of the following means:

a) use of stainless steel conforming to the requirements of EN 10088-2;

b) by completely covering any mild steel reinforcement conforming to the requirements of EN 10218-2 with a coating (e.g. Portland cement CEM I or CEM II mixed with water to form a slurry, or epoxy resin).

6 Surface treatment

Any surface treatment of the outer wall element, e.g. render, coating, shall be applied as described by the product manufacturer, prior to testing.

7 Form, dimensions and tolerances

7.1 Form

Outer wall elements covered by this standard shall be manufactured in one of the following forms:

a) with a single passage to accommodate a flue liner;

b) with up to four passages to accommodate a combination of up to four flue liners and/or duct/s used for ventilation/combustion air.

7.2 Dimensions

Outer wall elements shall have a wall thickness not less than 20 mm.

7.3 Tolerances

Tolerances on manufacturer's declared dimensions, 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) Declared overall wall thickness

below 10 mm:	$^{+2}_{-1}$ mm
10 mm to 40 mm :	$^{+5}_{-1,5}$ mm
above 40 mm:	$^{+12}_{-5}$ %

7.4 Squareness of ends

When tested in accordance with either procedure described in A.3 of EN 1857:2010, the permissible deviation from squareness of ends of concrete outer wall elements shall not be greater than 10 mm at 'G' for the first procedure. With the second procedure the deviation shall not be more than 5 mm at 'G' for elements up to 400 mm and 8 mm at 'G' for elements greater than 400 mm in height.

8 Performance

8.1 Heat stress resistance

8.1.1 When an outer wall element, including those designated soot fire resistant, is tested as described in A.1 at the test temperature given in Table 1 appropriate to the designation, it shall also meet the requirements of 8.4.

When an outer wall element has multiple passages with an equal wall thickness, the heat stress test shall be carried out on the passage with the highest temperature designation.

8.1.2 Bends or fittings, made of the same material mix and by the same method of manufacture as the tested straight outer wall element, shall be deemed to conform to 8.1.1.

8.1.3 Outer wall elements, made of a different material mix or using a different method of manufacture from those in 8.1.2, shall be checked for heat stress resistance by testing a special straight test sample in accordance with 8.1.1. This straight test sample shall be made using the same material mix and manufacturing method as the outer wall elements.

8.1.4 If a bend or fitting is available in the range of products, the test assembly shall include a combination of the fitting equivalent to the size being tested. The outer wall element shall be installed according to the manufacturer's instructions.

8.1.5 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. The manufacturer shall declare the distance to the combustible partition and whether the gap between the outer wall element and the adjacent combustible partition is opened or closed. The above mentioned distance shall be determined by testing to the heat stress of A.1 at a temperature given in Table 1 appropriate to the product designation.

Table 1 — Heat stress test temperature

Temperature class	Temperature of flue gas °C
T 600	$700\ ^{+50}_{0}$
T 450	$550\ ^{+50}_{0}$
T 400	$500\ ^{+50}_{0}$
T 300	$350\ ^{+35}_{0}$
T 250	$300\ ^{+30}_{0}$
T 200	$250\ ^{+25}_{0}$
T 160	$190\ ^{+19}_{0}$
T 140	$170\ ^{+17}_{0}$
T 120	$150\ ^{+15}_{0}$
T 100	$120\ ^{+12}_{0}$
T 080	$100\ ^{+10}_{0}$

8.2 Heat shock resistance

8.2.1 Following the heat stress resistance test required in 8.1, when an outer wall element designated as soot fire resistant is tested as described in A.1.4 to a flue gas temperature of 1 000 °C for a period of 30 min ± 1 min, the element shall subsequently meet the requirements of 8.4.

When an outer wall element has multiple passages with an equal wall thickness, the heat shock test shall be carried out on the passage with the highest temperature designation.

NOTE The test described in A.1.4 is the method used to assess the sootfire resistance.

8.2.2 Bends or fittings, made of the same material mix and by the same method of manufacture as the tested straight outer wall element, shall be deemed to conform to 8.2.1.

8.2.3 Outer wall elements, made of a different material mix or using a different method of manufacture from those described in 8.2.2, shall be checked for heat shock resistance by testing a special straight test sample in accordance with 8.2.1. This straight test sample shall be made using the same material mix and manufacturing method as the outer wall elements.

8.2.4 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 test assembly is tested at the test temperature of 1 000 °C over a period of 30 min. The manufacturer shall declare the distance to the combustible partition and whether the gap between the outer wall element and the adjacent combustible partition is opened or closed. This distance shall not exceed the distance determined as described in 8.1.5.

8.3 Thermal resistance

Thermal resistance shall be measured according to the method given in A.4 of EN 1858:2008 (reference method) or calculated according to the method given in Annex C of EN 1858:2008 and the value obtained declared.

8.4 Compressive strength

8.4.1 When tested as described in A.8 of EN 1857:2010, straight outer wall elements shall withstand an intensity of loading equivalent to 4 times the manufacturer's declared structural height before subjecting the element to the thermal performance test(s) and three times the manufacturer's declared structural height after subjecting the element to the thermal performance test(s).

8.4.2 Outer wall element bends and fittings made of the same material mix and by the same method of manufacture as the tested straight elements shall be deemed to conform to 8.4.1.

8.4.3 Outer wall elements made from a different material mix, or using a different method of manufacture from those described in 8.4.2, shall be checked for compressive strength by testing a special straight test sample in accordance with 8.4.1. This special straight test sample shall be made using the same material mix and manufacturing method as the bend or fitting.

8.5 Bulk density

When outer wall elements are tested as described in A.10 of EN 1857:2010, the lowest and highest bulk density value shall be within a tolerance of ± 10 % of the manufacturers declared bulk density for the outer wall element.

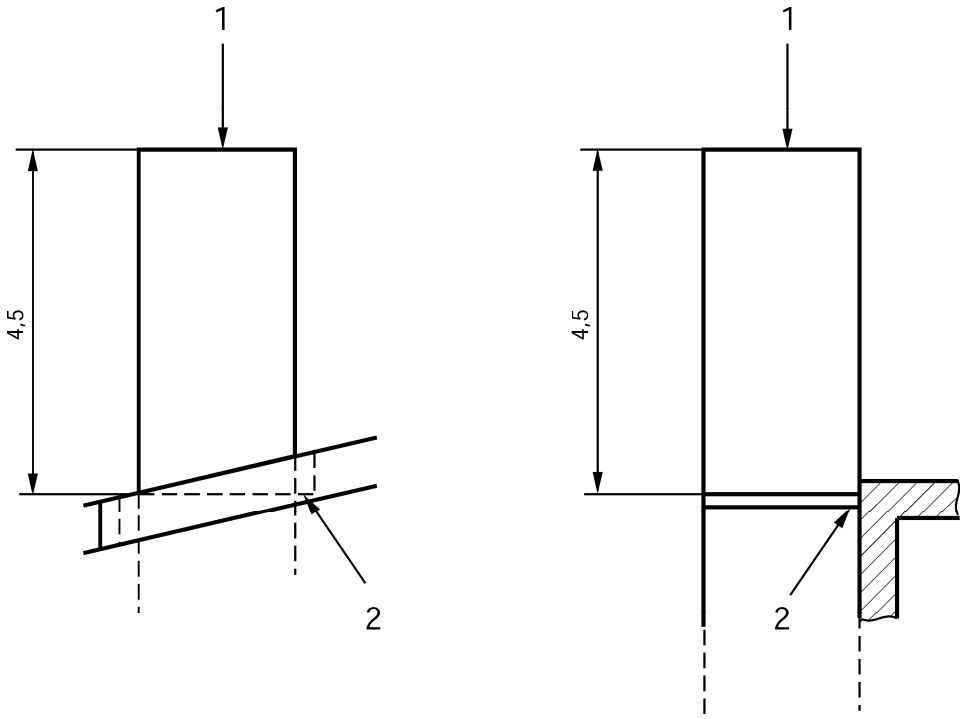
8.6 Freeze-thaw resistance

Where national regulations require freeze/thaw resistance of wall elements, 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.

8.7 Flexural strength under wind loading

The manufacturer shall declare the maximum free standing height of outer wall elements.

Without testing, this shall be no greater than 4,5 times the least lateral overall external dimension of the outer wall element from the last point of lateral support, see Figure 2.



Key

1 top of chimney excluding any terminal or chimney pot

2 last point of support

Figure 2 — Explanation of last point of support

Alternatively, the free standing part of the outer wall element above the last lateral support shall withstand a wind load of 1,5 kN/m^2 (or a value according to national regulations) when tested in accordance with A.2.

8.8 Gas tightness of passages used for combustion air

The gas tightness of the passage of an outer wall element, which is to be used for the air supply duct of a room sealed chimney application, shall be at least N2 (as defined in EN 1857) when measured after thermal testing. The gas tightness test shall be carried out in accordance with A.3.

8.9 Resistance to fire external to external

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

8.10 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.

9 Designation

9.1 Designations and classes

Outer wall elements shall be designated according to their intended nominal working temperature and their resistance to sootfire, as given in 9.2 to 9.6.

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

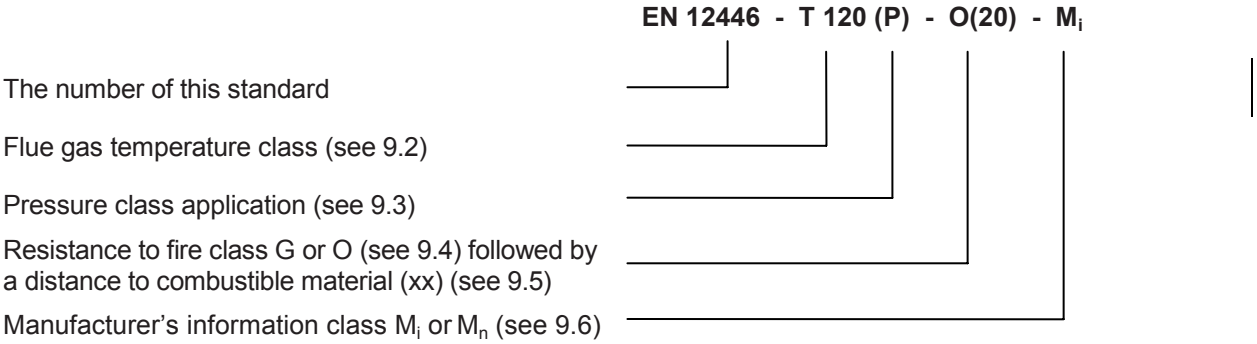


Figure 3 — Example of a designation system

9.2 Temperature classes

The temperature class shall be as specified in EN 1443.

9.3 Pressure class application

The pressure class signifies the heat flow used for thermal testing of the outer wall element, i.e:

— N for negative pressure conditions;

— P for positive pressure conditions;

— H for high positive pressure conditions.

9.4 Soot fire resistance class

The soot fire resistance class, which shall conform to EN 1443, shall be as follows:

— O for outer wall components tested without soot fire conditions;

— G for outer wall components tested with soot fire conditions.

9.5 Distance to combustible materials

The distance to combustible materials shall be as specified in EN 1443.

The designation of the distance of the outer surface of the wall components shall be given as xx, where xx is the distance in mm for the tested temperature class and sootfire conditions.

9.6 Manufacturer’s information class

The products shall be designated:

— M_n for outer wall components for all applications;

— M_i for outer wall components only for use according to manufacturer's specific instruction/specifications.

10 Marking

NOTE For CE marking and labelling, reference should be made to ZA.3.

A minimum of 20 % of the outer wall components in each consignment shall be legibly and indelibly marked with the following information:

a) name or trademark of the manufacturer;

b) manufacturer's batch or date code;

c) number of this European Standard;

d) designation in accordance with 4.2.

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;

e) thermal resistance;

f) manufacturer's declared structural height;

g) detailed installation instructions including instructions for surface treatment;

h) where national regulations require resistance to fire external to external (see EN 1443) of outer wall elements, they shall be evaluated and declared in accordance with those regulations;

i) freeze thaw;

j) class of combustibility (see 4.1);

k) structural height;

l) identification of passages used for combustion air.

12 Evaluation of conformity

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:

a) type testing;

b) factory production control.

12.2 Initial type testing

Type tests relating to material composition shall be performed initially together with factory production control tests as given in Table 2. One test shall be carried out for each requirement.

The thermal testing shall be carried out on one size of flue liner for each geometrical configuration e.g. circular, square, rectangular with the smallest wall thickness of the outer wall elements. The test with circular flue liners shall be done with the biggest diameter of the flue liner of the production line up to 200 mm ± 50 mm. For other geometrical configurations the flue liner shall have an equivalent cross-sectional area range.

12.3 Further type tests

Type tests shall be performed when a change that affects the declared performance of the product is made either in material composition, processing technique or to the design or method of manufacture of the flue liner, but they can be performed more frequently by incorporation into a plan for monitoring the consistency of manufacture (see Table 2).

Table 2 — Factory production control and type tests

Item	Relevant requirement clauses	
	Factory production control 12.3[a]	Type tests 12.1 and 12.2
Outer wall elements and fittings	4.1; 5; 6; 7.2, 7.3; 7.4; 8.4; 8.5	8.1 to 8.9;

[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 shall be carried out following manufacture to monitor the quality of product (see Table 3).

Sampling and testing of any batch shall be completed prior to removal from the works and shall be in accordance with ISO 2859-1 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 B).

NOTE 1 Batches rejected under the factory production control procedure can 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 2 A quality system assessed by a certification body which complies with the requirements of EN ISO/IEC 17021 can be applied to ensure that the requirements of EN ISO 9001 and Clause 12 are complied with.

Annex A
(normative)

Test methods

A.1 Heat stress resistance and heat shock test

A.1.1 Apparatus

NOTE The heat shock test is a method to assess the chimney for its ability to resist sootfire.

A.1.1.1 A heat generator capable of delivering completely combusted hot gas at the test temperature given in Table A.1, having a CO/CO_2 ratio not greater than 0,01, with the appropriate volume flow for the cross section given in Table A.1 with the heat source shielded.

Table A.1 — Hot gas velocity in m/s at test temperature

		Temperature class											
		T 080	T 100	T 120	T 140	T 160	T 200	T 250	T 300	T 400	T 450	T 600	Sootfire
		Test temperature /°C											
Pressure class	D in mm	100	120	150	170	190	250	300	350	500	550	700	1000
Negative pressure	100	1,67	1,76	1,90	2,00	2,08	2,36	2,60	2,84	3,56	3,81	4,55	5,09
	120	1,68	1,77	1,91	2,00	2,10	2,38	2,62	2,86	3,59	3,83	4,58	5,58
	160	1,71	1,80	1,94	2,04	2,13	2,42	2,66	2,91	3,65	3,90	4,66	5,56
	200	1,74	1,84	1,99	2,08	2,18	2,48	2,72	2,97	3,73	3,98	4,76	5,41
Positive pressure	100	2,35	2,47	2,65	2,77	2,90	3,26	3,56	3,85	4,73	5,01	5,86	5,09
	120	2,39	2,52	2,71	2,83	2,95	3,32	3,62	3,93	4,82	5,11	5,98	5,58
	160	2,51	2,64	2,84	2,97	3,10	3,48	3,80	4,12	5,06	5,36	6,27	5,56
	200	2,66	2,80	3,01	3,15	3,29	3,70	4,03	4,37	5,36	5,69	6,65	5,41
High positive pressure	100	5,15	5,36	5,68	5,88	6,08	6,63	7,05	7,44	8,36	8,59	9,07	5,09
	120	5,28	5,50	5,83	6,04	6,24	6,81	7,24	7,63	8,58	8,82	9,31	5,58
	160	5,62	5,86	6,20	6,42	6,64	7,24	7,70	8,12	9,13	9,39	9,91	5,56
	200	6,06	6,32	6,69	6,92	7,16	7,81	8,30	8,75	9,84	10,12	10,68	5,41

NOTE The flow rates are for heat generation from natural gas combustion.

A.1.2 Test assembly

The thermal testing shall be carried out on one size of flue liner for each geometrical configuration e.g. circular, square, rectangular with the smallest wall thickness of the outer wall elements. The test with circular flue liners shall be done with the biggest diameter of the flue liner of the production line up to 200 mm ± 50 mm. For other geometrical configurations the flue liner shall have an equivalent cross-sectional area range.

Construct a test sample of outer wall element to give a minimum overall height of 2,0 m jointed in accordance with the manufacturer's instructions (see Figure A.1). For outer wall element less than or equal to 1,0 m manufacturer's declared height, the assembly shall consist of a minimum of two complete flue blocks and joints. Outer wall elements of manufacturer's declared height of greater than 1,0 m may be cut and the test

assembly formed from two cut pieces, each having a height greater than 0,5 m and having only one joint near the centre of the assembly.

Either:

a) install the test sample in a free standing manner; or

b) install the test sample, in the test assembly as shown in Figure A.1 adjacent to the combustible partition, at the manufacturer's declared distance to combustibles. Seal the openings with non-combustible materials (sides and top, see Figure A.1), unless the manufacturer allows the gap to be ventilated. The partition shall consist of nominal dimension 38 mm $\times$ 89 mm thick timbers in a framework (see Figure A.2), faced on each side with one layer of nominally 12 mm thick plywood to give a total thickness of 114 mm ± 1,0 mm insulated in the voids, with mineral wool insulation having a thermal conductivity of 0,035 W/(m · K) ± 0,002 W/(m · K) at 20 °C ± 10 °C, with a minimum density of 70 kg/m^3 ± 10 kg/m^3. The walls shall extend 1 200 mm ± 12 mm.

Install bends and fittings, including access components and condensate collectors according to the manufacturer's instructions and if an access unit is provided for connecting flue pipes to boilers, include it in the test assembly. For fittings include a complete element.

Do not test base/condensate units if they are of the same material and have at least the same wall thickness as a straight outer wall element.

Test access units with single wall access as complete elements.

If the manufacturer of the outer wall element specifies the type of liner for use with the outer wall element with or without insulation and/or an air gap, include them in the test assembly, and construct the assembly in accordance with the manufacturer's instructions. If the manufacturer does not specify the form of liner to be used with the outer wall, install a single wall stainless steel liner (1.4404 in accordance with EN 10088-2:2005) having a wall thickness of 0,4 mm in the centre of the outer wall elements.

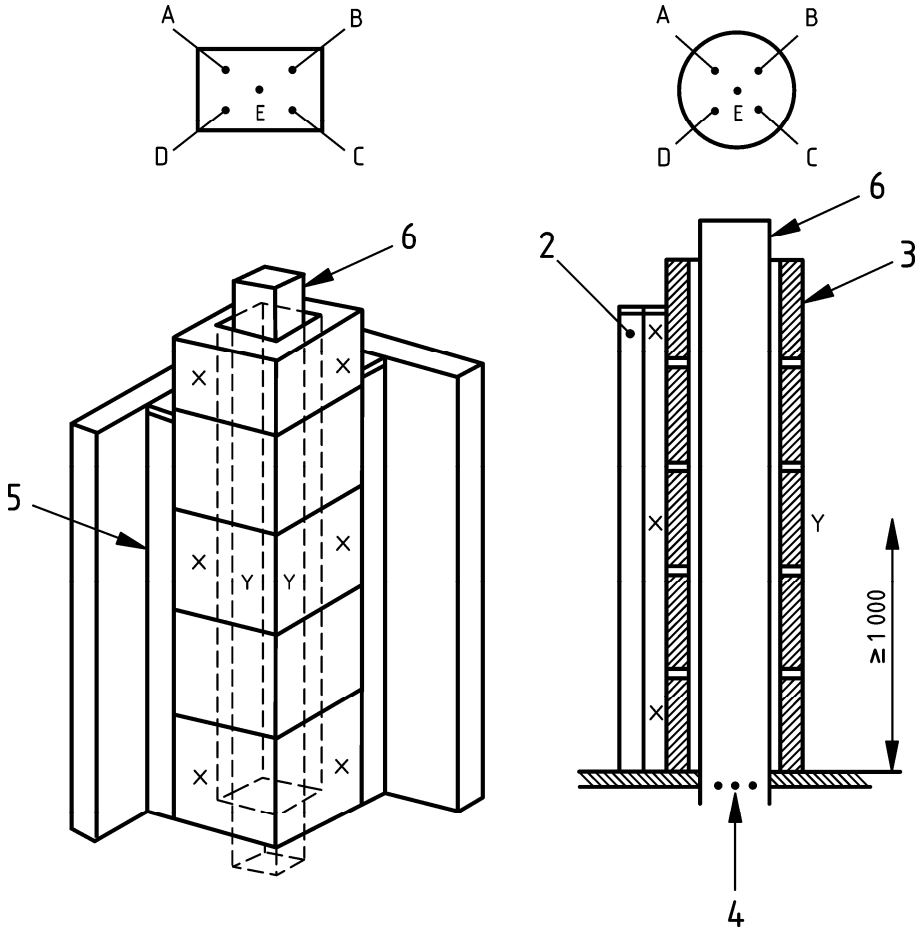
The liner shall have the same cross sectional profile as the opening in the outer wall elements and be positioned so that the gap between the outer wall elements is 20^{+10}_{-0} mm. The gap between the liner and outer wall shall be sealed at the top and bottom of the assembly. If the outer wall has more than one passage, test the passage declared by the manufacturer.

NOTE Passages can be used for ventilation or to contain a flue liner.

The passage for which the highest temperature designation is given shall be tested. The remaining passages declared as being flue liner passages shall be sealed at top and bottom. The ventilation passage shall not be sealed.

Apply any surface treatment according to any manufacturer's instructions.

Dimensions in millimetres

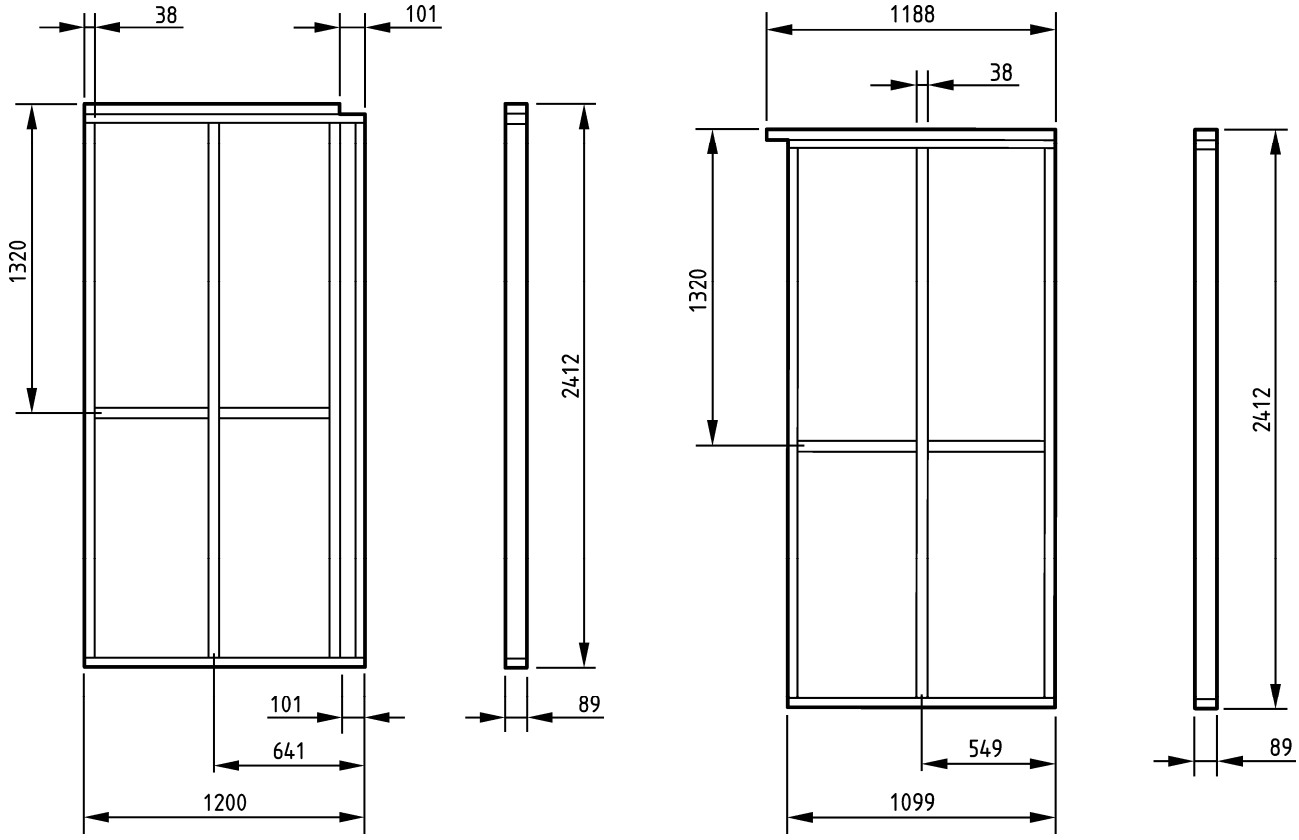


Key

2	partition
3	outer wall element
4	hot gas temperature measurement points
5	seal
6	liner (see A.1.2)
A to E	location of hot gas thermocouples
Y	outer wall temperature
X	partition temperature

Figure A.1 — Thermal test assembly

Dimensions in millimetres



a) Wall Frame Side 1 Zone B **b) Wall Frame Side 2 Zone B**

Figure A.2 — Wall frames

A.1.3 Test environment and conditioning

A.1.3.1 Test room

The test room shall provide the following conditions:

— ambient air temperature: 15 °C up to 30 °C;

— draughts into the test room: ≤ 0,5 m/s;

NOTE This requirement is assumed to be met by a closed room environment.

— location of measurements: minimum height of 1,0 m above the floor and at least 1,0 m from the walls;

— minimum distance between the chimneys and other structures (i.e. walls): 1,0 m;

— free connecting space if the laboratory is divided in several levels.

These ambient air conditions are measured a maximum of 1,0 m from the test assembly.

Limit deviation of measurements shall be:

— ± 1,5 °C for the ambient temperature;

— ± 0,05 m/s for the velocity of draughts;

— ± 0,05 m for the distances.

A.1.3.2 Assembly conditioning

Condition the test assembly for a minimum of 28 days at ambient temperature unless otherwise specified by the manufacturer.

A.1.3.3 Dry/conditioning phase

Unless otherwise specified by the manufacturer, deliver flue gases into the test assembly in such a way that the temperature, measured as described in A.1.4, rises to 200 °C or the nominated test temperature, whichever is the lower, in 60 min ± 5 min.

A.1.4 Procedure

Determine the gas tightness of the passage of an outer wall element, which is to be used for the air supply duct of a room sealed chimney application.

Establish an overall temperature distribution factor ($OTDF$) not exceeding 1,05 by taking five measurements of temperature along two transverses at right angles across the element within 50 mm of the entry. The locations for temperature measurement shall be positioned according to Figure A.1. Point E shall be central, points A to D shall be (20 ± 2) mm from the inner surface.

Calculate the overall temperature distribution factor, $OTDF$, using the equation:

$$OTDF = \frac{t_{\mathrm{HSAE}}}{t_{\mathrm{ASAE}}}$$

where

t_{HSAE} is the highest temperature at sensors A to E;

t_{ASAE} is the mean temperature at sensors A to E.

Deliver completely combusted gas in accordance with the flow rates specified in Table A.1 appropriate to the pressure class reference, into the test sample and within 10 min raise the temperature of the gas uniformly to the appropriate test temperature, as given in EN 1443:2003, Table 1, measured at the locations given above.

Maintain the delivery of gas until the temperature at any of the specified points of measurement does not rise by more than 2 K in 30 min (equilibrium) or to a maximum time of 4 h.

For the test assembly described in A.1.2 a) the points of measurement shall be on the exposed faces of the test sample, at the mid point of a complete flue block near the centre of the assembly or at least 100 mm from a joint. For rectangular sections, the measurement shall be taken at the mid point of the longer side.

For the test sample described in A.1.2 b) additional points of measurement shall be on both faces of the combustible partition at a location opposite to the mid point of the test sample and, where the space between the test sample and partition is closed, at a point 50 mm inside the space from the ends of the test sample, opposite its centre line.

Allow the test assembly to cool to ambient without assistance, e.g. without forced ventilation.

For the heat shock test, with the same apparatus, test assembly and test environment and conditions, maintain the flue gas temperature at $1\,000\,^{+50}_{0}$ °C for a period of (30 ± 1) min. Continue measuring the test assembly temperatures until maximum values have been reached and are reducing.

Determine the maximum temperatures at the points of measurement.

Determine the gas tightness of the passage of an outer wall element, which is to be used for the air supply duct of a room sealed chimney application.

Determine the gas tightness of the liner passage of the outer wall element.

A.1.5 Test results

Record the maximum temperature of the test sample, and either:

— if the test temperature described in A.1.2 a) was used, calculate what the surface temperature of a combustible partition, having a thermal resistance of 0,4 m^2 K/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

NOTE 1 A method for calculating the surface temperature of adjacent combustible material is given in EN 15287-1 [3].

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

— if the test assembly described in A.1.2 b) was used, record the maximum surface temperature of the combustible partition. Record the leakage rate of the test sample.

A.2 Flexural strength under wind load

A.2.1 Principle

The test methodology for the evaluation of flexural strength under wind load consists of measuring the tilt momentum of a chimney top under a horizontal load (see Figure A.3).

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) according to national regulations.

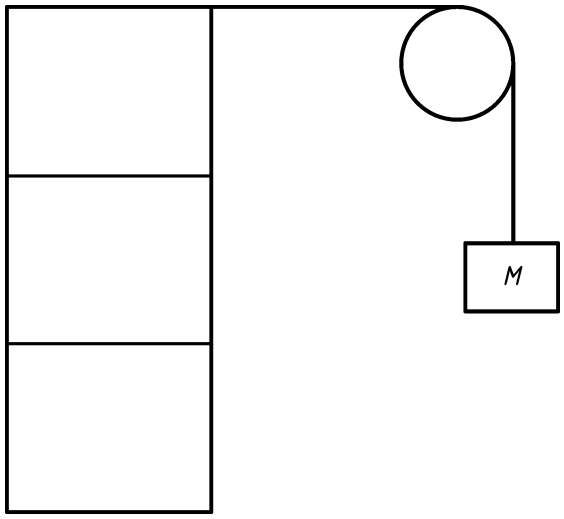
A.2.2 Preparation of test specimen

The test shall be carried out with an outer wall element of at least 1 m height. The test specimen consists of the manufacturer's declared components (e.g. inner liner, insulation and the outer wall element). The outer wall element shall be fitted without mortar, the inner liner shall be with jointing material specified by the manufacturer.

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

A.2.3 Test procedure

Fit the components together on the floor. 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. Record the measured tilt-load M in kN.



Key

M tilt-load,

Figure A.3 — Wind load test

A.3 Gas tightness test

A.3.1 Apparatus

A test assembly as described in A.1.2.

A means of creating a gas tight seal at each end of the liner passage or the air passage as appropriate.

Two pieces of tubing passing through and sealed into one of the airtight seals.

A fan capable of producing at least the required differential pressure, a flow meter and a manometer shall be used. The air supply for the test shall be measured by a flow meter with a limit deviation of ± 5 % of full scale. The full scale reading shall be approximately the flow rate for the maximum air permeability rate for the appropriate class of flue block.

A pressure gauge capable of measuring pressure to a limit deviation of ± 5 %.

A.3.2 Test environment and conditioning

The test environment and conditioning shall be as given in A.1.3.

A.3.3 Procedure

Plug both ends of the test assembly with an airtight seal. At one end insert two lengths of tubing (see Figure A.4).

Blow air through one of the tubes at a rate sufficient to achieve and maintain 20 Pa pressure measured on the pressure gauge.

A.3.4 Result

Calculate the leakage rate "E" of the assembly expressed in l m^{-2} s^{-1} using the following formula:

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

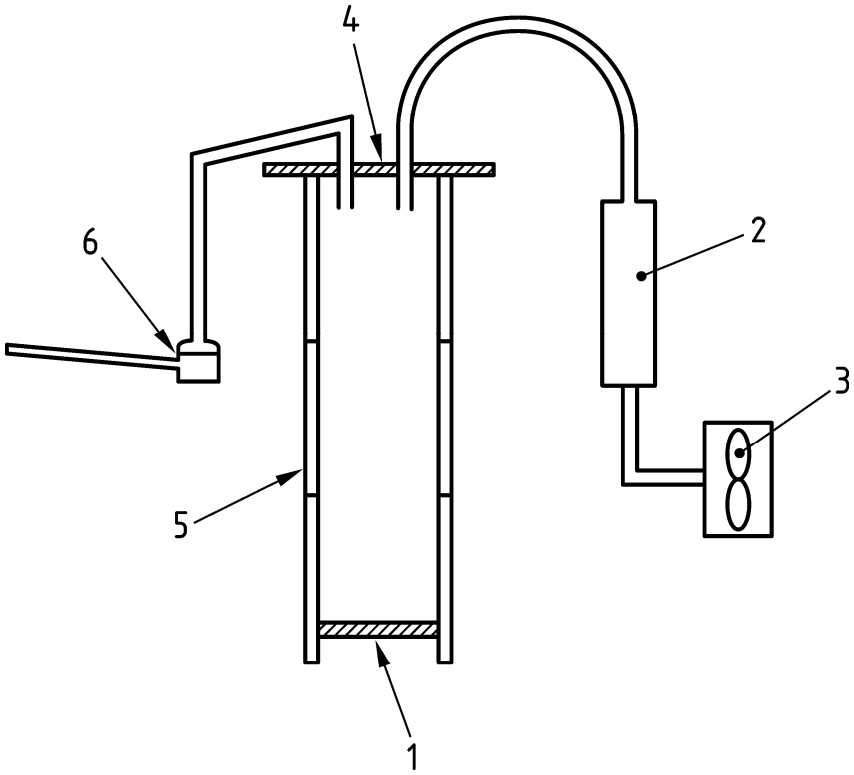
where

E is the leakage rate, in litres per second (l m^{-2} s^{-1});

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

t is the test duration, in seconds (s);

S is the inside surface area of the flue block, in square meters (m^2).



Key

1	seal	4	seal
2	flow meter	5	jointed flue blocks
3	fan	6	pressure gauge

Figure A.4 — Air leakage measurement

Annex B
(normative)

Requirements of sampling plan according to ISO 2859-1 at an Acceptable Quality Level (AQL) and inspection level S2 Inspection Procedure

B.1 Acceptability determination

B.1.1 General

Single or double sampling may be used.

B.1.2 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 inspection reinstated.

B.1.3 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.

B.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 Tables B.1 to B.4. Sample units shall be selected at random.

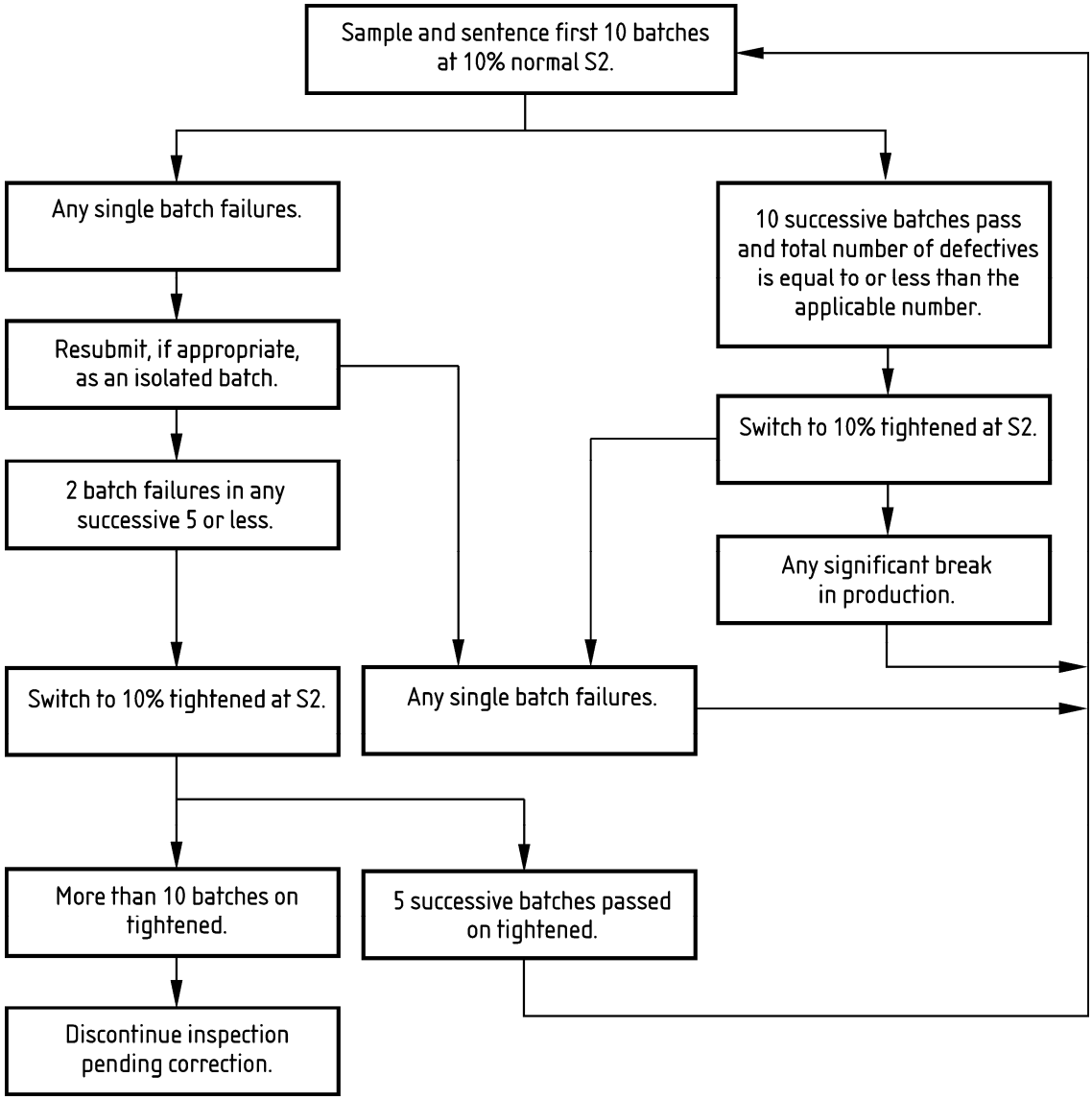


Figure B.1 — Summary of sampling procedures (Continuous batches)

Table B.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

B.3 Reduced Inspection

A reduced inspection level as shown in Table B.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 10 preceding batches (or such other number required by Table B.3) is equal to or less than the limit number given in Table B.3.

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

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

Number of samples from last 10 batches	Limit number of defectives
20 to 29	0
30 to 49	0
50 to 70	2
80 to 129	4

B.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 met (see B.1.2 and B.1.3).

B.5 Tightened inspection

Tightened inspection as shown in Table B.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 B.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

B.6 Tightened to normal inspection

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

B.7 Discontinuation of inspection

If ten consecutive batches remain on tightened inspection, the provisions of this sampling plan shall be discontinued pending action to improve the quality of the submitted batches.

Annex ZA
(informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This European Standard has been prepared under Mandate M/105 'Chimneys, flues and specific products', as amended by mandate M/117 and M/134 given to CEN by the European Commission and the European Free Trade Association.

The clauses of this European Standard shown in this annex meet the requirements of the Mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the outer wall elements and fittings covered by this European Standard for their intended uses indicated herein; reference should be made to the information accompanying the CE marking.

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended use, may be applicable to a construction product falling within the scope of this standard.

NOTE 1 In addition to any specific clauses relating to dangerous substances contained in this Standard, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

NOTE 2 An informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA http://ec.europa.eu/enterprise/construction/cpd-ds/

This annex establishes the conditions for the CE marking of the precast concrete outer wall elements intended for the uses indicated in Table ZA.1 and shows the relevant clauses applicable.

This annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.

Table ZA.1 — Scope and relevant clauses

Construction product:	**Precast concrete outer wall elements and fittings as covered by clause 1**		
Intended uses:	**Chimney component that surrounds a flue liner to form the outer wall of a chimney or part of a system chimney**		
Performance characteristic	Requirement clauses in this standard	Levels and/or classes	Notes
Thermal resistance	8.3 Thermal resistance	None	Declared value of thermal resistance
Resistance to fire internal to external	8.1 Heat stress resistance	O xx	Non sootfire resistant products are classified O xx
	8.2 Heat shock resistance	G xx	Sootfire resistant products are classified G xx
Resistance to fire external to external	8.9 Resistance to fire external to external	None	As declared
Reaction to fire	4.2 Reaction to fire	A1	Classified without test
Compressive strength	8.4 Compressive strength	None	Declared structural height
Flexural strength	8.7 Flexural strength under wind loading	None	Declared maximum unsupported height
Durability: resistance to freeze-thaw	8.6 Freeze-thaw resistance	None	Pass/fail
Dangerous substances	8.10 Dangerous substances	None	As indicated in ZA.1 and ZA.3

The requirement on a certain characteristic is not applicable in those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure of attestation of conformity of concrete outer wall elements

ZA.2.1 System of attestation of conformity

The system of attestation of conformity for concrete outer wall elements and fittings for chimneys indicated in Table ZA.2, in accordance with the decision of the Commission 95/467/EC of 24 October 1995, as amended by 01/596/EC of 8 January 2001 and 2002/592/EC of 15 July 2002 (published as doc. L192 the 20.07.02, as given in Annex III of the mandate M/105 "Chimneys" as amended, is shown in Table ZA.2 for the indicated intended use.

Table ZA.2 — Attestation of conformity system

Product	Intended use	Level or class (Reaction to fire)	Attestation of conformity system
Multi-wall chimney outer wall elements	**Chimney component**	**Any**	**2+** [a]

[a] System 2+: See CPD annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of its continuous surveillance, assessment and approval.

The attestation of conformity of the products in Table ZA.1 shall be according to the evaluation of conformity procedure indicated in Table ZA.3 resulting from application of the clauses of this European Standard indicated therein.

Table ZA.3 — Assignment of evaluation of conformity tasks

Tasks			Content of the task	Evaluation of conformity clauses to apply
Tasks under the responsibility of the manufacturer	Factory production control (FPC)		Parameters related to all characteristics of Table ZA.1 relevant for the intended use	12.4 and Annex B
	Initial type testing by the manufacturer		"Those characteristics of Table ZA.1 relevant for the intended use not tested by the notified test lab"	12.2
	Testing of samples taken at the factory		All characteristics of Table ZA.1 relevant for the intended use	12.3 and 12.4
	Certification of FPC by the FPC certification body on the basis of	Initial inspection of factory and of FPC	Parameters related to all characteristics of Table ZA.1, relevant for the intended use,	12.3 and 12.4
		Continuous surveillance, assessment and approval of FPC	Parameters related to all characteristics of Table ZA.1, relevant for the intended use,	12.3 , 12.4 and Annex B

ZA.2.2 EC Certificate and Declaration of conformity

When compliance with the conditions of this annex is achieved, and once the notified body has drawn up the certificate mentioned below, the manufacturer or his agent established in the EEA should prepare and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking. This declaration should include:

a) name and address of the manufacturer, or his authorized representative established in the EEA, and the place of production;

NOTE 1 The manufacturer may also be the person responsible for placing the product onto the EEA market, if he takes responsibility for CE marking.

b) description of the product (type, identification, use, ...), and a copy of the information accompanying the CE marking;

NOTE 2 Where some of the information required for the Declaration is already given in the CE marking information, it does not need to be repeated.

c) provisions to which the product conforms (e.g. Annex ZA of this EN);

d) particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc);

e) number of the accompanying factory production control certificate;

f) name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorized representative.

The declaration should be accompanied by a factory production control certificate, drawn up by the notified body, which should contain, in addition to the information above, the following:

g) name and address of the notified body;

h) number of the factory production control certificate;

i) conditions and period of validity of the certificate, where applicable;

j) name of, and position held by, the person empowered to sign the certificate.

The above mentioned declaration should be presented in the official language or languages of the Member State in which the product is to be used.

ZA.3 CE Marking and labelling

The manufacturer or his authorized representative established within the EU or EFTA is responsible for the affixing of the CE marking.

The CE conformity symbol to affix should be in accordance with Directive 93/68/EEC together with the identification number of the notified body, as well as the name or identifying mark of the producer, the number of the standard and the product designation and should be shown on at least 20 % of the outer wall elements in each consignment.

In addition, the CE marking should appear on the packaging and/or on the accompanying documents, together with the following information: All the information should appear together in at least one location (e.g. the commercial documents).

a) Identification number of the notified body;

b) last two digits of the year in which the marking is affixed;

c) name or identifying mark of the producer;

d) registered address of the producer;

e) number of the certificate of the factory production control;

f) reference to this European Standard with the version date;

g) description of the product: Product type;

h) information on the relevant essential characteristics in Table ZA.1:

   1) values presented as standard designation(s) see Clause 9 including any information on surface treatment;

   2) values and, where relevant, level to declare for each essential characteristic not included in the designation as indicated in "Notes" in Table ZA.1;

   3) “No performance determined” (NPD) option where relevant.

The "No performance determined" (NPD) option may not be used where the performance characteristic is subject to a threshold value. Otherwise, the NPD option may be used when and where the performance characteristic, for a given intended use, is not subject to regulatory requirements.

Figure ZA.1 and Figure ZA.2 give examples of the information to be given on the product, packaging and/or accompanying documents.

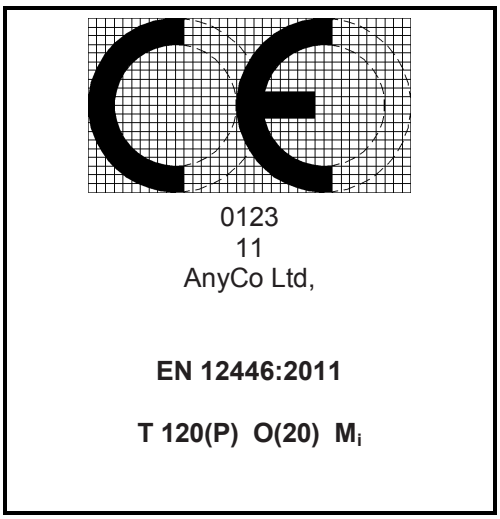


Figure ZA.1 — Example CE marking information affixed on the product

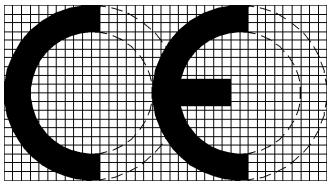
		CE conformity marking consisting of the 'CE' symbol given in directive 93/68/EC
0123		Identification number of the notified body
11		Last two digits of year of affixing of CE marking
AnyCo Ltd, P.O. Box 21, B – 1050		Name or identifying mark and registered address of the producer
0123-CPD-0001		Number of FPC certificate
EN 12446: 2011		Number of European Standard with the version date
Concrete outer wall elements **T 120(P) O(20) M_i**		Definition of the product and appropriate designation according to Clause 9
Thermal resistance	0,2 m^2 K/W	Information on mandated characteristics not included in the designation or threshold values to be given (see Table ZA.1)
Structural Height	30 m	
Wind load	1,5 kN	
Durability: Freeze-thaw	NPD.	
Reaction to fire:	A 1	
Resistance to fire external to external	NPD	
Release of dangerous Substances:	None	

Figure ZA.2 — Example of CE marking information in the accompanying documents

In addition to any specific information relating to dangerous substances shown above, the products should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

NOTE 1 European legislation without national derogations need not be mentioned.

NOTE 2 Affixing the CE marking symbol means, if a product is subject to more than one directive, that it complies with all applicable directives.

Bibliography

[1] EN 206-1:2000, *Concrete — Part 1: Specification, performance, production and conformity*

[2] EN ISO 9001, *Quality management systems — Requirements (ISO 9001:2000)*

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

[4] EN 15287-1, *Chimneys — Design, installation and commissioning of chimneys — Part 1: Chimneys for non-roomsealed heating appliances*

[5] EN ISO/IEC 17021, *Conformity assessment — Requirements for bodies providing audit and certification of management systems (ISO/IEC 17021:2006)*

[6] Commission Decision 96/603/EC

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