

Chimneys — Clay/ceramic flue liners — Requirements and test methods

The European Standard EN 1457:1999, incorporating amendment A1:2002, has the status of a British Standard

ICS 91.060.40

National foreword

This British Standard is the UK implementation of EN 1457:1999, incorporating amendment A1:2002 and corrigenda May 2006 and April 2007. It supersedes BS 1181:1989 which is withdrawn.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by A1 A1.

The UK participation in its preparation was entrusted by Technical Committee B/506, Chimneys, to Subcommittee B/506/3, Chimneys and their components having inner linings of clay/ceramic.

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

EN 1457:1999 as amended is a “harmonized” European Standard and fully takes into account the requirements of the European Commission mandate M105, *Chimneys*, given under the EU Construction Products Directive (89/106/EEC), and is intended to lead to CE marking.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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This British Standard was published under the authority of the Standards Committee and comes into effect on 15 July 1999

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ISBN 978 0 580 59188 4

Amendments issued since publication

Amd. No.	Date	Comments
14077	13 February 2003	See revised national foreword
16474 Corrigendum No. 1	30 June 2006	Corrections to tables 1, 3, 5, 6 and ZA.1, subclauses 9.1, 9.2 and 16.8.6 and Figure A.1
17376 Corrigendum No. 2	31 October 2007	NOTE 3 added to Clause ZA.1

Descriptors: flue ducts, ceramics, definitions, classifications, dimensional tolerances, compressive strength, thermal shock tests, water absorption tests, density (mass/volume), acid resistance, sampling, tests, designation, marking

English version

Chimneys — Clay/ceramic flue liners — Requirements and test methods

Conduits de fumée — Conduits intérieurs en
terre cuite/ceramique — Exigences et méthodes
d'essai

Abgasanlagen — Keramik-Innenrohre —
Anforderungen und Prüfungen

This European Standard was approved by CEN on 26 December 1998.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 166, Chimneys, the Secretariat of which is held by UNI.

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 July 1999, and conflicting national standards shall be withdrawn at the latest by January 2000.

This European Standard 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).

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

On drafting this standard the provisional requirements already available from prEN 1443 were taken into account. When further requirements are received, any necessary amendments will be made.

Foreword to amendment A1

This document EN 1457:1999/A1:2002 has been prepared by Technical Committee CEN/TC 166, Chimneys, the Secretariat of which is held by UNI.

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 April 2003, and conflicting national standards shall be withdrawn at the latest by April 2003.

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), see informative Annex ZA, which is an integral part of this document.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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1 Scope

This European Standard is a product standard for clay/ceramic flue liners with solid walls or walls with vertical perforations for use in the construction of A_1 multiwall A_1 chimneys and flue pipes which serve to convey products of combustion from fireplaces or heating appliances to the atmosphere by negative or positive pressure. It includes the flue liners used for domestic and industrial chimneys which are not structurally independent (free-standing). This standard specifies the performance requirements for factory made flue liners and chimney fittings. Testing, marking and inspection are covered by this standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 312-4, *Particleboards — Specifications — Part 4: Requirements for load-bearing boards for use in dry conditions*.

A_1 EN 1443, *Chimneys — General requirements*. A_1

EN 10088-1, *Stainless steels — Part 1: List of stainless steels*.

A_1 Text deleted A_1

ISO 2859-1, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection*.

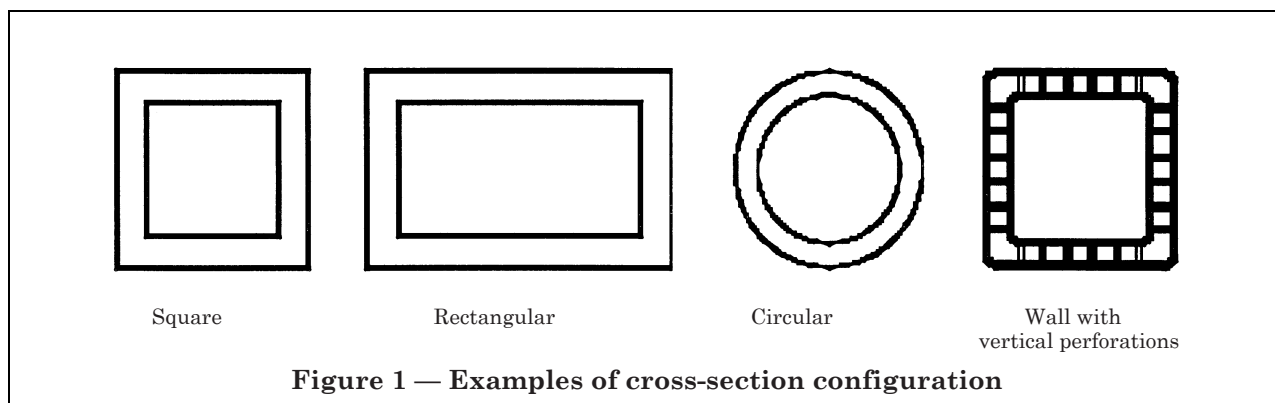
ISO/DIS 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines*. (Revision of ISO 7500-1:1986)

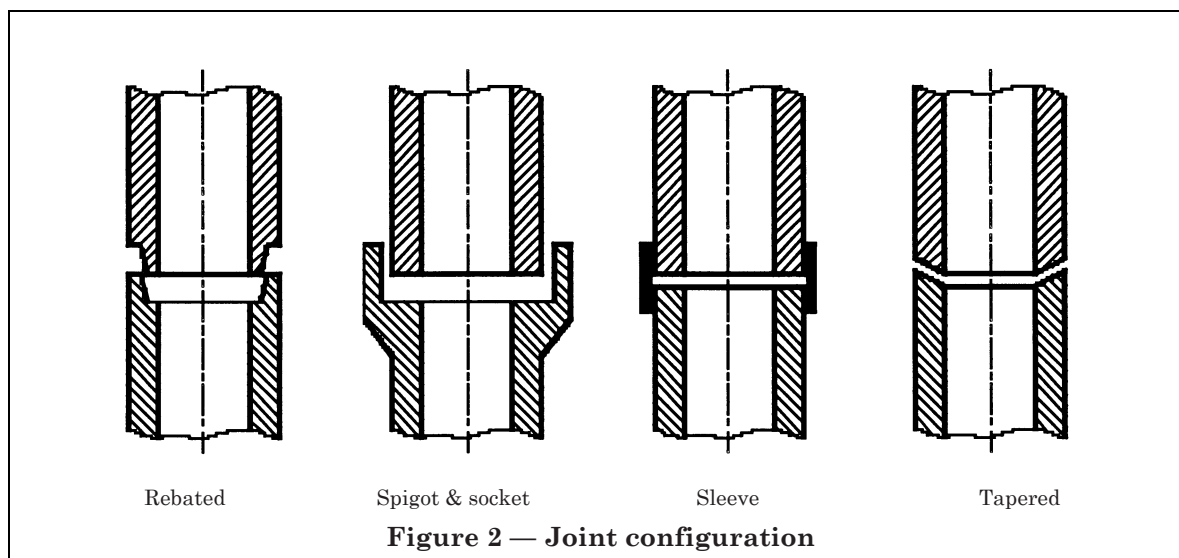
3 Flue liners and openings

3.1 Flue liner cross-sections

Flue liners shall be either:

- circular A_1 or square A_1 in cross-section with rebated or spigot and socket ends;
- square or rectangular in cross-section with rebated ends and rounded internal corners;
- circular, square or rectangular in cross-section with butt joints and jointed with a sleeve;
- circular or square in cross-section with taper joints.





3.2 Inspection openings, chimney junctions and inspection doors

Inspection openings are used for inspection and cleaning of the inner liners of chimneys and for soot removal and shall meet the requirements of flue liners as appropriate.

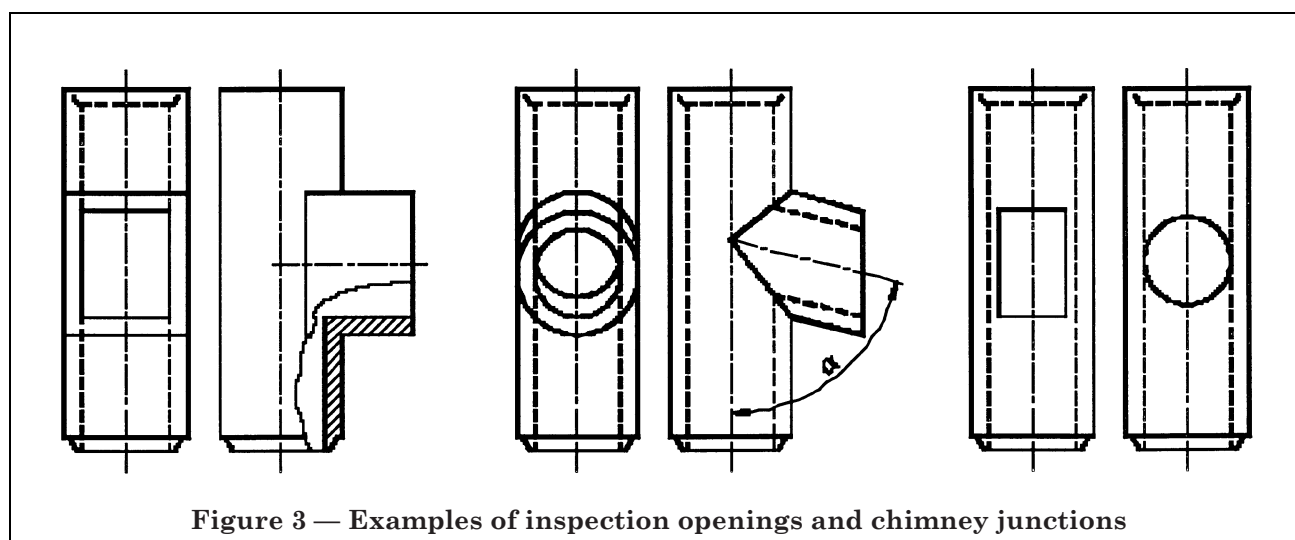
All inspection openings shall have a door.

The inspection door shall be one of the following:

- a) a single sheet door for chimneys working only in dry conditions;
- b) a door with a separate humidity barrier or with two sheets for chimneys working under dry and wet conditions.

Chimney junctions are used to connect flues from heat appliances to chimneys. Chimney junctions are purpose-made tee-pieces or inner liner sections with an opening to which branches are fitted. The branch angles can be 45° to 90° (α in Figure 3). At the position of junctions, the outer walls shall have corresponding openings.

Chimney junctions should have the same cross-sectional area as the flue liner. Reductions and expansions are acceptable provided that the resistance to the exhaust gases is not increased.



4 Definitions

For the purposes of this standard, the following definitions apply. Other definitions are given in prEN 1443.

4.1

nominal size

a numerical designation of size which is a convenient round number equal to or approximately equal to either:

- a) the internal diameter in millimetres of circular flue liners;
- b) the internal width in millimetres of square flue liners;
- c) the internal width and breadth in millimetres of the cross-section of rectangular flue liners

4.2

nominal height

a numerical designation of the internal height in millimetres of a straight flue liner which is a convenient round number approximately equal to the internal height of the flue liner (see Figure 4)

4.3

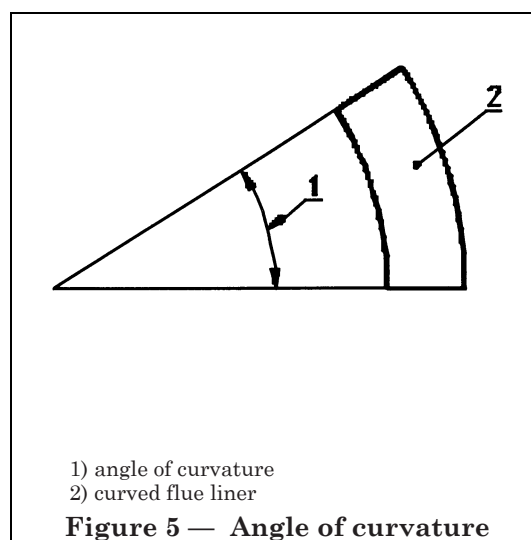
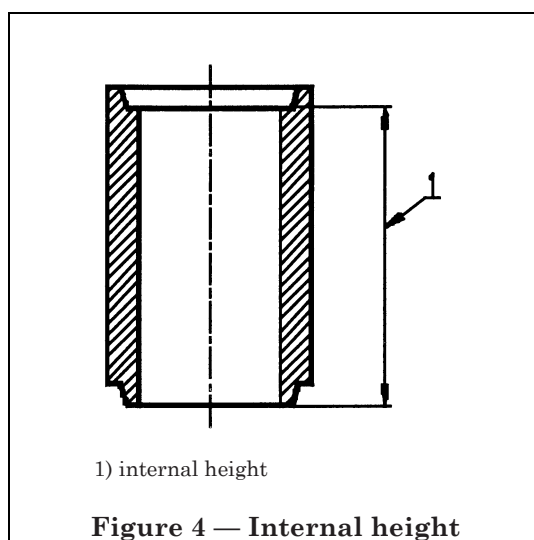
nominal angle of curvature

the angle subtended in degrees by a curved flue liner at the centre of the curve (see Figure 5)

4.4

resistance to fire of flue liners

ability of the flue liners and fittings to be resistant to soot fire A_1



5 A_1 Types of flue liner

There are four main types of clay/ceramic flue liner dependent on working temperature, with sub-types dependent on whether the flue liners are to be used in chimneys designed to work under negative or positive pressure, or are to have soot fire resistance. The types, working temperatures, test pressures and maximum air permeability rates are given in Table 1. The suitability of each type of flue liner to be used in chimneys designed to operate under negative or positive pressure and wet or dry conditions is also given.

NOTE A flue liner can be designated in one or more types provided that it complies with the appropriate requirements for each type. A_1

Table 1 — Types of clay/ceramic flue liners, conditions of use, air test pressures and maximum air permeability rates after thermal testing

Type of flue liner	Working temperature °C	Negative or positive pressure	Soot fire resistance	Wet or dry conditions	Test pressure Pa	Maximum air permeability $\text{m}^3 \cdot \text{s}^{-1} \cdot \text{m}^{-2} \cdot 10^{-3}$
A1 N2	600	Negative	Yes (G)	Dry	20	3
A1 N1	600	Negative	Yes (G)	Dry	40	2
A2 N2	600	Negative	No (O)	Dry	20	3
A2 N1	600	Negative	No (O)	Dry	40	2
A2 P1	600	Positive	No (O)	Dry and wet	200	0,006
B1 N2	400	Negative	Yes (G)	Dry	20	3
B1 N1	400	Negative	Yes (G)	Dry	40	2
B2 N2	400	Negative	No (O)	Dry and wet	20	3
B2 N1	400	Negative	No (O)	Dry and wet	40	2
B2 P1	400	Positive	No (O)	Dry and wet	200	0,006
C1 N2	300	Negative	No (O)	Dry	20	3
C1 N1	300	Negative	No (O)	Dry	40	2
C2 N2	300	Negative	No (O)	Dry and wet	20	3
C2 N1	300	Negative	No (O)	Dry and wet	40	2
C2 P1	300	Positive	No (O)	Dry and wet	200	0,006
D1 N2	200	Negative	Yes (G)	Dry	20	3
D1 N1	200	Negative	Yes (G)	Dry	40	2
D2 N2	200	Negative	No (O)	Dry and wet	20	3
D2 N1	200	Negative	No (O)	Dry and wet	40	2
D3 N2	200	Negative	No (O)	Dry and wet	20	3
D3 N1	200	Negative	No (O)	Dry and wet	40	2
D3 P1	200	Positive	No (O)	Dry and wet	200	0,006

(A1)

6 Materials

Flue liners shall be manufactured from suitable clay/ceramic material which when fired meets the performance requirements given in this standard.

Flue liners may be unglazed or glazed on the interior and/or exterior. When glazed, they need not be glazed on the jointing surfaces.

7 **(A1)** Tolerances on dimensions **(A1)**

7.1 **(A1)** Transverse dimension **(A1)**

When tested in accordance with **16.1**, the internal diameter of circular flue liners measured on any diameter shall not deviate more than ± 3 % of the manufacturer's stated nominal internal diameter.

The internal width or breadth of square or rectangular section flue liners shall not deviate more than ± 3 % of the manufacturer's stated nominal internal length of the side.

7.2 Height

When tested in accordance with **16.2**, the height of a flue liner shall not deviate more than ± 3 % of the manufacturer's stated nominal height subject to a maximum value of 10 mm.

7.3 Angle of curvature

When tested in accordance with **16.3**, the angle of curvature of curved flue liners shall not deviate more than $\pm 5^\circ$ of the manufacturer's stated nominal curvature.

7.4 Straightness

When tested in accordance with 16.4, the permissible deviation from straightness of straight flue liners shall be 1 % of the test length.

7.5 Squareness of ends

When tested in accordance with 16.5, the permissible deviation from square of the ends of straight flue liners shall be not greater than an angle of slope 30 mm/m.

7.6 Deviation from shape of cross-section

When tested in accordance with 16.6, the permissible deviation from square of the angles of, and flatness of, walls for square or rectangular shape straight flue liners, shall be not greater than 5 % of the manufacturer's stated nominal internal width or breadth.

7.7 Joints

The design and dimensions of the joints shall be as specified by the manufacturer to provide an adequate joint.

8 Proof load

8.1 Straight flue liners

When tested in accordance with 16.7, straight flue liners shall withstand an intensity of loading of 10 MN/m².

8.2 Curved flue liners

Where curved flue liners are fired in a plant alongside straight flue liners, using the same materials and firing process, the proof load of these curved flue liners is deemed to be that of the straight flue liners when tested in accordance with 16.7.

If curved flue liners are not normally fired alongside straight flue liners, straight flue liners or short lengths of straight flue liners made for test purposes, using the same materials and firing process as for curved flue liners, shall be tested for compliance with the requirements of 8.1.

8.3 Minimum load for inspection opening sections

When tested in accordance with 16.7, the minimum load of inspection opening sections shall be as given in Table 2.

Table 2 — Minimum load

Height of chimney m	Minimum load kN
≤ 12,5	25
> 12,5 ≤ 25	50
> 25 ≤ 50	100

For chimneys with areas greater than 0,04 m² the following equation shall be used:

$$F = \chi HG$$

where

- F is the minimum load in kilonewtons;
- χ is the safety factor = 5;
- H is the height of chimney in metres;
- G is the mass per metre in kilograms per metre.

9 ^{A1} Gastightness, thermal shock resistance and resistance to fire for straight flue liners ^{A1}

9.1 Initial test

Prior to thermal testing, a test flue constructed in accordance with 16.8.3 with N1 and N2 liners shall have a leakage rate not greater than $2 \text{ m}^3 \cdot \text{s}^{-1} \cdot \text{m}^{-2} \cdot 10^{-3}$ of internal surface area tested at a differential pressure of $(40 \pm 2) \text{ Pa}$ when tested as described in 16.8.5.

Prior to thermal testing, a test flue constructed in accordance with 16.8.3 with P1 liners shall have a leakage rate not greater than $0,006 \text{ m}^3 \cdot \text{s}^{-1} \cdot \text{m}^{-2} \cdot 10^{-3}$ of internal surface area tested at a differential pressure of $(200 \pm 10) \text{ Pa}$ when tested as described in 16.8.5.

^{A1} 9.2 Final gas tightness after thermal shock testing (sootfire)

When tested in accordance with 16.8 flue liners A1, B1 and D1 shall have a leakage rate after thermal shock testing not greater than the values given in Table 3 for the appropriate type of flue liner, test temperature and differential pressure.

9.3 Final gas tightness after thermal shock testing

When tested in accordance with 16.8 flue liners not included in 9.2 shall have a leakage rate after thermal testing not greater than the values given in Table 3 for the appropriate type of flue liner, test temperature and differential pressure. ^{A1}

Table 3 — Test temperature, differential pressure and permeability rate

^{A1} Type ^{A1} of flue liner	Test temperature °C	Differential pressure Pa	Maximum air permeability rate $\text{m}^3 \cdot \text{s}^{-1} \cdot \text{m}^{-2} \cdot 10^{-3}$
A1 N2	1 000	20	3
A1 N1	1 000	40	2
A2 N2	700	20	3
A2 N1	700	40	2
A2 P1	700	200	0,006
B1 N2	1 000	20	3
B1 N1	1 000	40	2
B2 N2	500	20	3
B2 N1	500	40	2
B2 P1	500	200	0,006
C1 N2	350	20	3
C1 N1	350	40	2
C2 N2	350	20	3
C2 N1	350	40	2
C2 P1	350	200	0,006
D1 N2	1 000	20	3
D1 N1	1 000	40	2
D2 N2	250	20	3
D2 N1	250	40	2
D3 N2	250	20	3
D3 N1	250	40	2
D3 P1	250	200	0,006

10 Acid resistance

When tested in accordance with 16.9, the mass loss from any test piece shall not exceed the values given in Table 4.

NOTE This is an accelerated test to represent a corrosion resistance and practical installed life of at least 100 years.

Table 4 — Acid resistance

$\square_{A1}$ Type $\langle A1 \rangle$ of flue liner	Mass loss %
A1 N2, A1 N1, A2 N2, A2 N1, B1 N2, B1 N1	5
A2 P1, B2 N2, B2 N1, B2 P1, C1 N2, C1 N1, C2 N2, C2 N1, C2 P1, D1 N2, D1 N1, D2 N2, D2 N1, D3 N2, D3 N1, D3 P1,	2

11 Water absorption and bulk density

11.1 General

The flue liner body shall be tested for either water absorption or bulk density for production control.

11.1.1 Water absorption

When tested in accordance with 16.10, the mean water absorption values expressed as a percentage of five samples shall not vary more than $\pm 2,5$ % from the mean value obtained $\square_{A1}$ from the last type test. $\langle A1 \rangle$

11.1.2 Bulk density

When tested in accordance with 16.11, the mean bulk density of five samples shall not vary more than ± 100 kg/m³ from the mean value obtained $\square_{A1}$ from the last type test. $\langle A1 \rangle$

12 $\square_{A1}$ Abrasion resistance $\langle A1 \rangle$

When tested in accordance with 16.12, the mass of any material dislodged shall not exceed 0,03 kg/m² of the total exposed area of the inner surface of the flue.

$\square_{A1}$ 13 Water vapour permeability and flow resistance

13.1 Water vapour permeability

When tested in accordance with 16.13, Type A2 P1, Type B2, Type C2, Type D2 and Type D3 straight flue liners for wet conditions shall not allow more than 2,0 g of water h⁻¹ m⁻² of flue liner internal surface to pass through the wall of the flue liners.

13.2 Flow resistance

Where required, determine the mean roughness of flue liners according to Annex C. $\langle A1 \rangle$

14 Thermal resistance

The values of thermal resistance of flue liners shall be stated by the manufacturer for a flue temperature of 200 °C $\square_{A1}$ and $\langle A1 \rangle$ calculated by the methods given in Annex B for the same temperature.

15 Evaluation of conformity

15.1 Initial type testing

Type tests relating to material composition shall be performed initially together with factory production control tests as given in Table 5. 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. For circular flue liners the size to be tested shall be 200 mm ± 50 mm internal diameter. For other geometrical configurations the flue liner shall have an equivalent cross-sectional area range.

15.2 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 liner, but they may be performed more frequently by incorporation into a plan for monitoring the consistency of manufacture (see Table 5)

Table 5 — Factory production control and type tests

Item	Relevant requirement clauses	
	Factory production control 15.3 ¹⁾	Type tests 15.1 and 15.2
Straight flue liners	7.1, 7.2, 7.4, 7.5, 7.6, 11	8.1, 9.2, 9.3, 10, 12 and 13
Flue liner bends	7.1, 7.3, 11	8.2, 10
¹⁾ The tests carried out during FPC are intended to verify that the performance requirements assessed through the initial type testing are maintained.		

15.3 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 5).

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 1 200 (see Annex A)

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 45012 can be applied to ensure that the requirements of ISO EN 9002 and Clause 15 are complied with. **Ⓐ**

16 Test methods

16.1 Size

The maximum and minimum diameters of a clay/ceramic flue liner shall be those calculated from the tolerances given in 7.1. If direct measurement is to be carried out, two measurements should be taken at the observed maximum and minimum diameters.

The test may also be carried out by using two gauges whose diameters are set at the minimum and maximum diameters. The minimum gauge should be able to be turned through 360° within the ends of the flue liner. The maximum gauge should not be able to enter the flue liner when tested through a rotation of 360°.

For square and rectangular flue liners, the internal cross-section dimensions shall be measured between the mid-points of opposite sides of the flue liners.