

Chimneys — Clay/ceramic flue blocks for single wall chimneys — Requirements and test methods

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National foreword

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This standard includes a national annex, giving recommendations for design and construction of clay flue block systems, which were formerly included in BS 1289-2. In future these recommendations may be covered by an execution standard being developed by CEN/TC 166, when this national annex will be deleted by amendment.

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 or ceramic, which has the responsibility to:

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 45 and a back cover.

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pour conduits de fumée simple paroi – Exigences et
méthodes d'essai

Abgasanlagen – Keramik-Formblöcke für einschalige
Abgasanlagen – Anforderungen und Prüfmethode

This European Standard was approved by CEN on 9 December 1999.

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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of an identical text or by endorsement, at the latest by October 2000, and conflicting national standards shall be withdrawn at the latest by April 2001.

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.

1 Scope

This European Standard specifies the requirements for clay/ceramic flue blocks with solid walls or walls with vertical perforations including bonding and non-bonding blocks and their fittings. Non-bonding flue blocks which have insulation in the vertical perforations or attached to the outer walls are also covered by this standard. This standard specifies the performance requirements for factory-made flue blocks. When they are installed, they will form a single-wall chimney which will serve to convey products of combustion from fireplaces or heating appliances to the atmosphere under negative pressure. This standard includes components used for domestic and industrial chimneys which are not structurally independent (free-standing). Testing, marking and inspection requirements 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	Particle boards – Specification – Part 4: Requirements for load bearing boards for use in dry conditions.
EN 1443	Chimneys – General requirements.
EN 10088-1	Stainless steels – Part 1: List of stainless steels.
EN 45012:1998	General criteria for certification bodies operating quality system certification.
EN ISO 9001:1994	Quality Systems. Model for quality assurance in design development, production, installation and servicing (ISO 9001:1994).
EN ISO 9002:1994	Quality Systems. Model for quality assurance in production, installation and servicing (ISO 9002:1994).
EN ISO 9003:1994	Quality Systems. Model for quality assurance in final inspection and test (ISO 9003:1994).
ISO 2859-1:1989	Sampling procedures for inspection by attributes – Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.
EN ISO 7500-1:1999	Metallic materials – Part 1: Verification of static uniaxial testing machines.

3 Product shape

3.1 General

Flue blocks may have flues which are either circular, square or rectangular. The joints shall have a locating feature such as a rebate.

3.2 Straight flue blocks

These are flue blocks designed to be used in a vertical section of a chimney having the ends perpendicular to the axis of the flue. When they are designed to be built wholly or partially into a masonry wall and having a bonding extension, they are called “bonding blocks”.

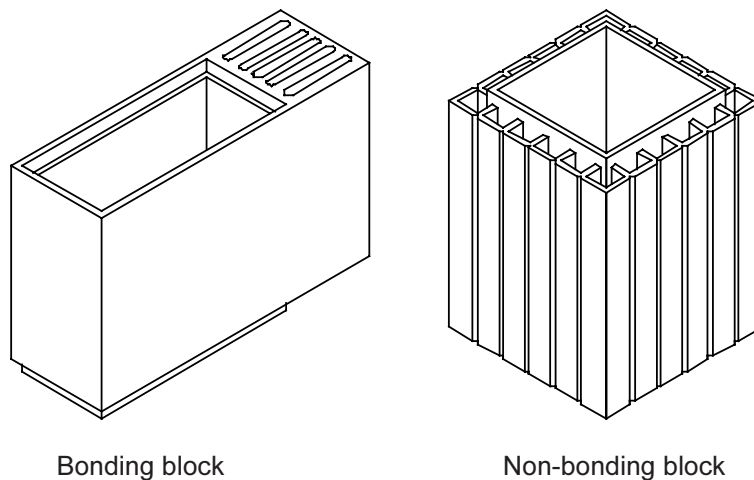


Figure 1: Examples of flue block shape

3.3 Form

Flue blocks covered by this standard shall be manufactured in three forms:

- a) single flue;
- b) multi-flue;
- c) flue/ventilation combination.

4 Definitions

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

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

- i) the internal diameter in millimetres of the circular flue passage, or
- ii) the internal width in millimetres of blocks with square section flues, or
- iii) the internal width and breadth in millimetres of the internal transverse dimensions of flue blocks with rectangular flueways

4.2 nominal height: a numerical designation of the height in millimetres of a standard flue block excluding any projecting spigot, which is a convenient round number

NOTE: For a bonding block, this is the co-ordinating height which equates to the nominal height of masonry building blocks for walls into which such a flue block is designed to be built.

4.3 angle block: to facilitate a change in angle of the axis of a flue

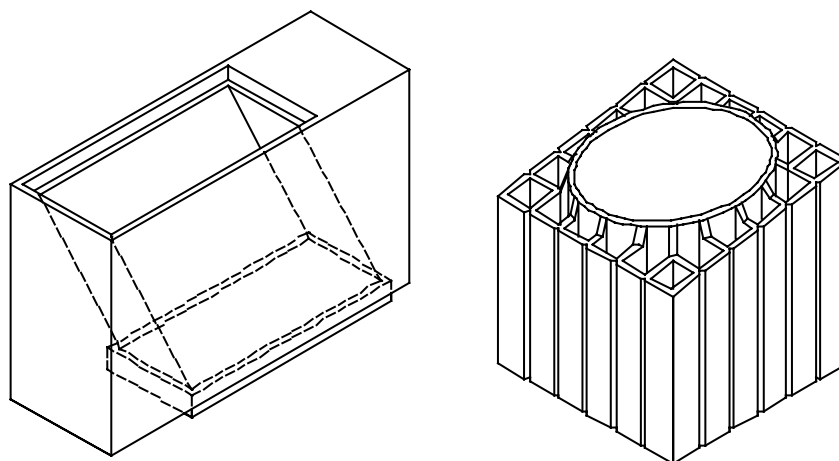


Figure: 2 Examples of angle block

4.4 bonding extension: that part of a flue block which is designed to be bonded into adjacent masonry walls, and forms no part of the chimney

4.5 transfer block: a flue block which changes the cross-section of the flue from rectangular to circular

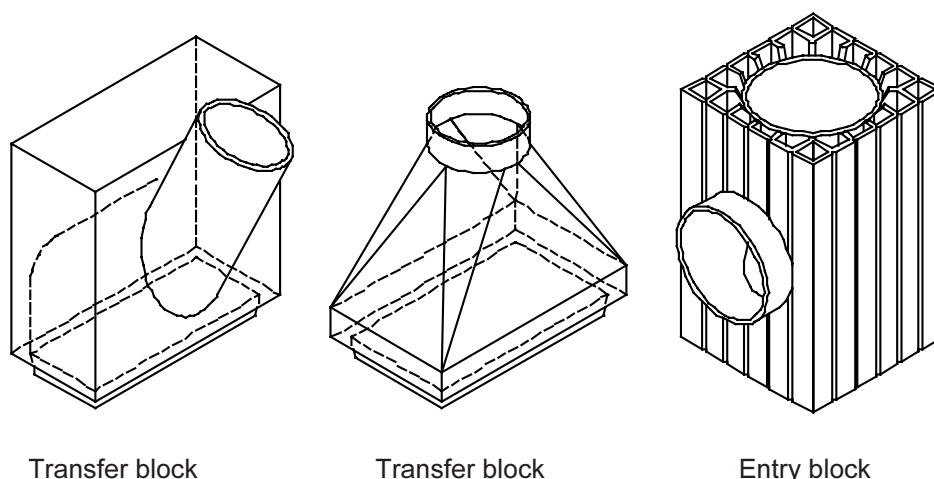


Figure 3: Examples of transfer blocks and entry point block

4.6 flue blocks with insulation in vertical perforations: flue blocks with perforations within the wall specially designed to house rigid insulation

4.7 flue blocks with attached insulation: flue blocks with insulation factory-fitted to the outer walls

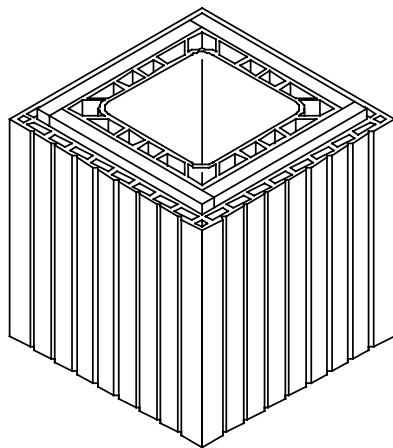


Figure 4a: Example of flue block with insulation in vertical perforation

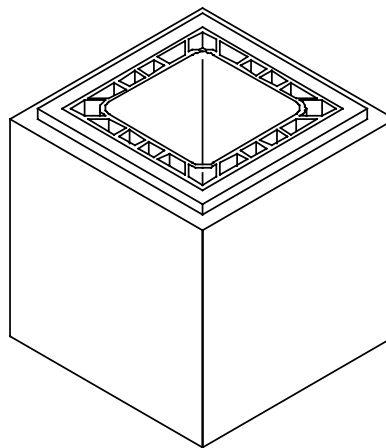


Figure 4b: Example of flue block with insulation attached

4.8 entry block: block connecting the chimney to the connecting flue pipe or the chimney to the appliance

5 Classes of flue block

Clay/ceramic flue blocks shall be classified as specified in Table 1.

Table 1: Classes and types of clay/ceramic flue blocks, conditions of use, air test pressures and maximum air permeability rates after thermal testing

Class of flue block	Type of block	Temperature		Negative pressure	Soot fire resistance	Wet or dry conditions	Test pressure [Pa]	Maximum air leakage rate [$\text{m}^3 \text{s}^{-1} \text{m}^{-2} \times 10^{-3}$]
		Working [°C]	Test [°C]					
FB1 N2	Non-bonding	600	1 000	N2	Yes	Dry	20	3
FB1 N1	Non-bonding	600	1 000	N1	Yes	Dry	40	2
FB2 N2	Non-bonding	600	700	N2	No	Dry	20	3
FB2 N1	Non-bonding	600	700	N1	No	Dry	40	2
FB3 N2	Non-bonding	400	500	N2	No	Dry & wet	20	3
FB3 N1	Non-bonding	400	500	N1	No	Dry & wet	40	2
FB4 N2	Non-bonding	300	350	N2	No	Dry & wet	20	3
FB4 N1	Non-bonding	300	350	N1	No	Dry & wet	40	2
FB5 N2	Non-bonding	200	250	N2	No	Dry & wet	20	3
FB5 N1	Non-bonding	200	250	N1	No	Dry & wet	40	2
FB6	Bonding	200	250	N2	No	Dry	20	3

A flue block may be classified in one or more classes provided it complies with the appropriate requirements for each class.

A designated class of flue block is suitable for use on all types of chimneys with a nominal working temperature up to a maximum of that designated. The designation for soot fire resistance and corrosion apply throughout the temperature range. All classes of clay/ceramic flue block are suitable for the appropriate pressure application. For clarification of the letters, see clause 17, e.g.:

Class FB1 N2 equals T600, N2, S, D, 3 and may also be used for:
T600, N2, O, D, 3;
T400, N2, S, D, 3;
T400, N2, O, D, 3;
T300, N2, O, D, 3;
T200, N2, O, D, 3.

Flue block classes for chimneys designed for use with low temperature products of combustion are included in this standard. When they are used with a system chimney, the whole chimney may be tested at the low working temperature for the determination of the minimum distance of combustibles away from the chimney. Flue blocks classified as dry, may be used in wet conditions if back ventilation is provided, see system chimneys with clay/ceramic flue liners or blocks standard clause 8.

6 Materials

6.1 Flue blocks

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

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

6.2 Insulation

6.2.1 Shape

The insulation shall have a permanent shape (e.g. blocks or bonded loose material). It shall not comprise loose material.

6.2.2 Density of insulation

The manufacturer shall declare the density of the insulation and this shall not vary by more than ± 10 % of the declared value after testing according to 17.15.

6.2.3 Resistance to heat

When tested in accordance with 17.14, the change in the surface temperature after the fourth cycle of heating shall not exceed 10 % of the maximum surface temperature of the first cycle.

7 Tolerances on dimensions

7.1 Internal transverse dimensions

When tested in accordance with 17.1, the internal diameter of flue blocks with circular flues measured on any diameter shall not deviate more than ± 3 % of the manufacturer's stated nominal internal diameter. For flue blocks with square and rectangular flueways, the tolerances on the internal widths and breadths shall not deviate more than ± 3 % of the manufacturer's stated nominal internal length of the side. Corners of the flue may be rounded.

7.2 Height

When tested in accordance with 17.2, the height of a flue block shall not deviate more than ± 3 % of the manufacturer's stated nominal height subject to a maximum value of 10 mm.

7.3 Angles

When tested in accordance with 17.3, the angle between the axes of the flues of angle or transfer blocks shall not be greater than 45° and shall not deviate more than $\pm 5^\circ$ of the manufacturer's stated nominal value.

7.4 Straightness

When tested in accordance with 17.4, the permissible deviation from straightness of straight flue blocks shall be 1 % of the test length.

7.5 Squareness of angles and flatness of walls

When tested in accordance with 17.5, the permissible deviation from square of the ends of straight flue blocks, 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 17.6, the permissible deviation from square of the angles of, and flatness of walls for square or rectangular shape straight flue blocks, 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.

7.8 Bonding extension

Any bonding extension, which may be solid or contain vertical perforations, shall be designed to extend into the adjacent masonry wall by not less than 75 mm (see Figure 1).

7.9 Tolerance on insulation thickness

The thickness of factory-fitted insulation on the outer walls of flue blocks shall not differ from the nominal value by more than the tolerances declared by the flue block manufacturer.

8 Proof load

8.1 Straight flue blocks

When tested in accordance with 17.7, straight flue blocks shall withstand an intensity of loading of 10 MN/m^2 .

8.2 Angle blocks

Where angle blocks are fired in a plant alongside straight flue blocks, using the same materials and firing process, the proof load of these angle blocks is deemed to be that of the straight flue blocks when tested in accordance with 17.7.

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

8.3 Minimum load for inspection opening sections

When tested in accordance with 17.5, the minimum load shall be as given in Table 2.

Table 2: Minimum load

Height of chimney [m]	Minimum load [kN]
$\leq 12,5$	25
$> 12,5 \leq 25$	50
$> 25 \leq 50$	100

For chimneys with area greater than $0,04 \text{ m}^2$, the following equation shall be used:

$$F = \chi \cdot H \cdot G$$

where:

F	minimum load (kN);
χ	safety factor = 5;
H	height of chimney (m);
G	weight per metre (kg/m).

8.4 Adhesion between outer wall and insulation

When tested in accordance with 17.16, the force required to separate the outer wall from the insulation shall be greater than 1 500 N.

9 Gastightness (leakage test) and thermal testing

9.1 Initial test

Prior to thermal testing, a test flue constructed in accordance with 17.8 shall have a leakage rate not greater than $2 \text{ m}^3 \text{ s}^{-1} \text{ m}^{-2} \times 10^{-3}$ of internal surface area tested at a differential pressure of $(40 \pm 2) \text{ Pa}$ when tested as described in 17.8.5.

9.2 Final gastightness (leakage test) after thermal testing

When tested in accordance with 17.8.5, flue blocks shall have leakage rate after thermal testing not greater than the values given in Table 1 for the appropriate class of flue block, test temperature and differential pressure.

10 Acid resistance

When tested in accordance with 17.9, the mass loss from any test piece shall not exceed 2 % for classes FB3, FB4 and FB5 flue blocks and 5 % for classes FB1, FB2 and FB6 flue blocks.

11 Water absorption and bulk density

11.1 General

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

11.2 Water absorption

When tested in accordance with 17.10, the mean water absorption of five test specimens from new production of flue blocks shall not vary more than $\pm 2,5$ % from the mean value obtained for five test specimens taken from flue blocks which have been subjected to the thermal type test.

11.3 Bulk density

When tested in accordance with 17.11, the mean bulk density of five test specimens from new production of flue blocks shall not vary more than $\pm 100 \text{ kg/m}^3$ from the mean value obtained for five test specimens taken from flue blocks which have been subjected to the thermal type test.

12 Sweeping resistance

When tested in accordance with 17.12, the mass of any material dislodged shall not exceed $0,03 \text{ kg/m}^2$ of the total exposed area of the inner surface of the flue.

13 Water and vapour flow resistance

When tested in accordance with 17.13, class FB3, class FB4 and class FB5 straight flue blocks shall not allow more than $2,0 \text{ g of water h}^{-1}\text{m}^{-2}$ of flue block surface to pass through the wall of the flue block.

14 Thermal resistance

The values of thermal resistance of flue blocks shall be stated by the manufacturer for a flue temperature of 200°C or calculated by the methods given in annex B for the same temperature.

15 Fire resistance

15.1 Testing at operating conditions

Flue blocks shall be tested in accordance with 17.14.2.2. The highest mean temperature calculated shall be rounded to the nearest higher 5°C and this shall be the minimum temperature for the manufacturer to declare as the reference temperature for the determination of the distance to combustibles.

15.2 Soot fire test

Flue blocks which are designated soot fire resistant shall be tested in accordance with 17.14.2.3. The highest mean temperature calculated shall be rounded to the nearest higher 5°C and this shall be the minimum temperature for the manufacturer to declare as the soot fire resistance reference temperature for the determination of the distance to combustibles.

16 Evaluation of conformity

16.1 Sampling and testing

Quality control tests shall be carried out following manufacture to monitor the quality of product.

Type tests are intended to prove the suitability and performance of a material composition, or processing technique or design or size of a flue block. Such tests should be performed when a change is made either in material composition, processing technique or to the design or size 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.

The relevant sampling procedures and test clauses are given in Table 3.

Table 3: Sampling procedures

Item	Relevant test clauses		
	Sampling procedure 16.2	Sampling procedure 16.3	Sampling procedure 16.4
Straight flue blocks	7.1, 7.2, 7.4, 7.5, 7.6 and 11	In respect only of the defect that caused initial rejection	8.1, 9.1 9.2, 10, 12, 13 and 15
Angle blocks	7.1, 7.3, and 11		8.2, 8.3, 10

16.2 Sampling for quality control at the manufacturer's works

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).

16.3 Sampling for resubmitted rejected batches

Batches rejected under the sampling procedure specified in 16.2 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.

16.4 Type tests

Sampling and tests relating to material composition and method of manufacture regarding proof load, thermal testing, acid resistance and water and vapour resistance shall be performed initially and whenever a change is made in material composition or method of manufacture.

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 ± 50) mm internal diameter. For other geometrical configurations, the flue block shall have an equivalent cross-sectional area range.