BRITISH STANDARD

BS EN
1806:2006

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

The European Standard EN 1806:2006 has the status of a British Standard

ICS 91.060.40; 91.100.25



BSI
British Standards

# National foreword

This British Standard is the official English language version of EN 1806:2006. It supersedes BS EN 1806:2000 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/506, Chimneys, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

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

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**Summary of pages**

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EUROPEAN STANDARD

NORME EUROPÉENNE

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# EN 1806

July 2006

ICS 91.060.40; 91.100.25

Supersedes EN 1806:2000

English Version

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

Conduits de fumée - Boisseaux en terre cuite/céramique pour conduits de fumée simple paroi - Exigences et méthodes d'essai

Abgasanlagen - Keramik - Formblöcke für einschalige Abgasanlagen - Anforderungen und Prüfmethoden

This European Standard was approved by CEN on 19 June 2006.

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

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

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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# Contents

Page

# Foreword

This document (EN 1806:2006) 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 January 2007, and conflicting national standards shall be withdrawn at the latest by January 2007.

This document supersedes EN 1806:2000.

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, 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 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 part of a multi-wall chimney or a complete chimney which will serve to convey products of combustion from fireplaces or heating appliances to the atmosphere.

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.

NOTE 1 Flue blocks covered by this standard are manufactured in three forms :

a) single flue ;

b) multi-flue ;

c) flue/ventilation combination.

NOTE 2 Flue blocks may have flues which are either circular, square or rectangular. The joints may have a locating feature such as a rebate.

## 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 312, *Particleboards – Specifications*

EN 1443:2003, *Chimneys – General requirements*

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

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

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

EN ISO 6946, *Building components and building elements - Thermal resistance and thermal transmittance - Calculation method (ISO 6946:1996)*

EN ISO 7500-1*, Metallic materials - Verification of static uniaxial testing machines - Part 1: Tension/compression testing machines - Verification and calibration of the force-measuring system (ISO 7500-1:2004)*

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

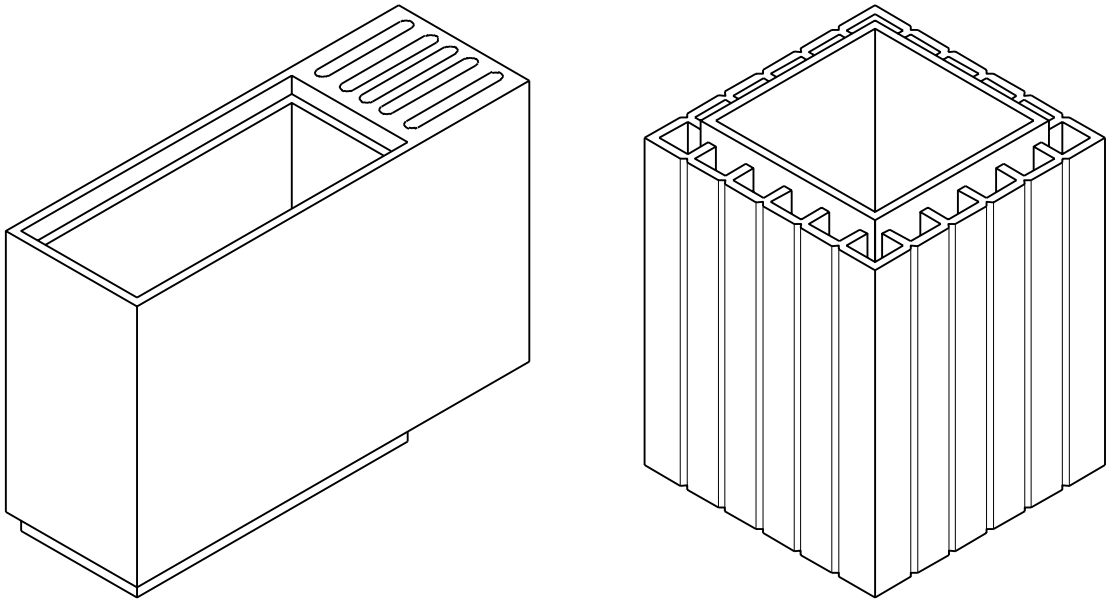
## 3 Terms and definitions

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

**3.1**
**angle flue block**
flue blocks designed to facilitate a change in angle of the axis of a flue (see Figure 2).

**3.2**
**bonding extension**
part of a flue block which is designed to be bonded into adjacent masonry walls, and forms no part of the chimney

**3.3**
**bonding flue block**
flue blocks designed to be built wholly or partially into a masonry wall and having a bonding extension



Bonding flue block Non-bonding flue block

**Figure 1 — Examples of flue block shape**

**3.4**
**entry flue block**
flue block connecting the chimney to the connecting flue pipe or the chimney to the appliance (see Figure 6)

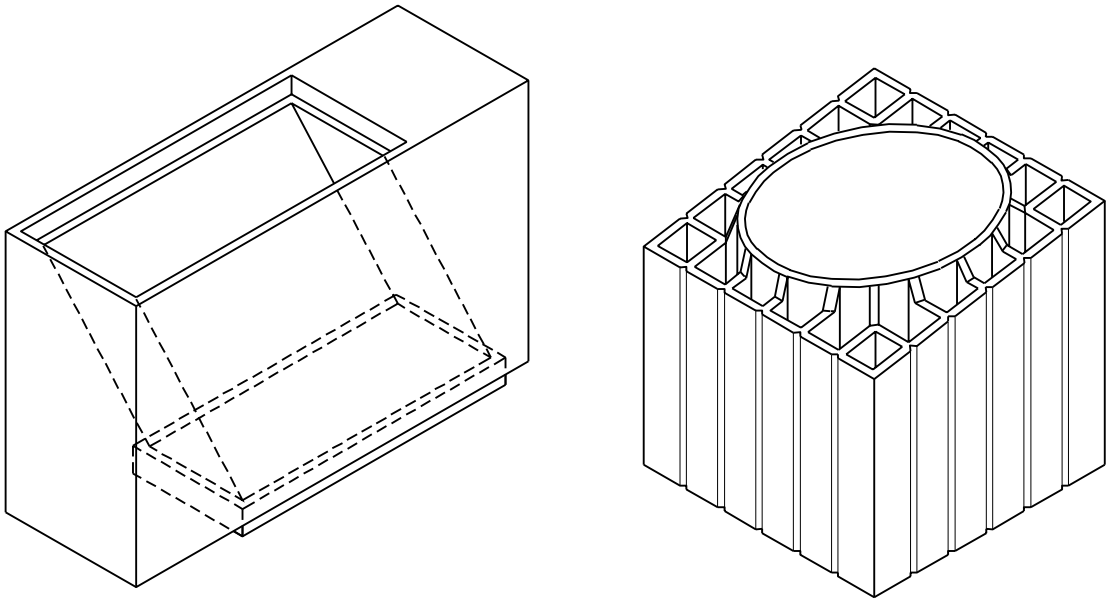


**Figure 2 — Examples of angle flue block**

**3.5**
**family**
group of products for which the test for one or more characteristics from any one product within the family are valid for all other products within the family

**3.6**
**flue blocks with attached insulation**
flue blocks with insulation factory-fitted to the outer walls (see Figure 5).

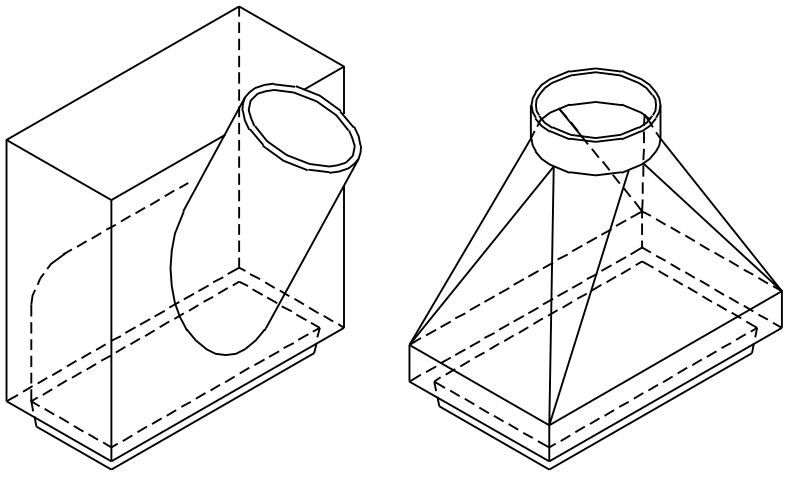


**Figure 3 — Examples of transfer flue blocks**

**3.7**
**flue blocks with insulation in vertical perforations**
flue blocks with perforations within the wall specially designed to house rigid insulation (see Figure 4).

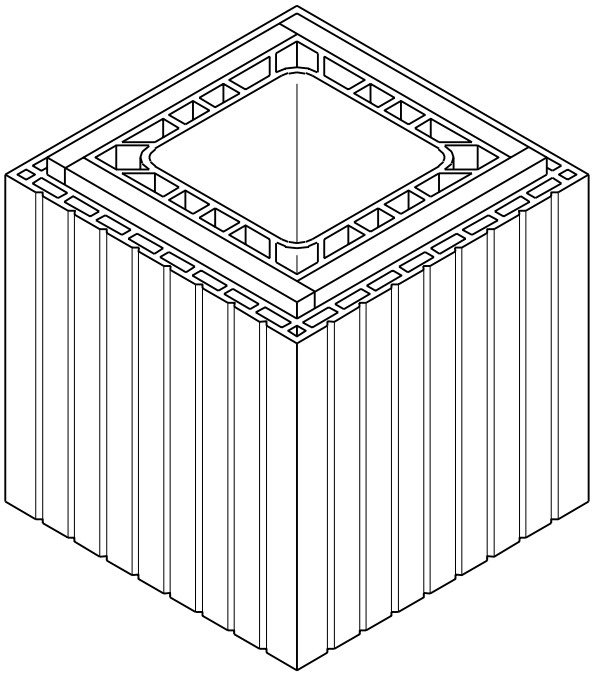


**Figure 4 — Example of flue block with insulation in vertical perforations**

**3.8**
**nominal height**
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 flue 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.

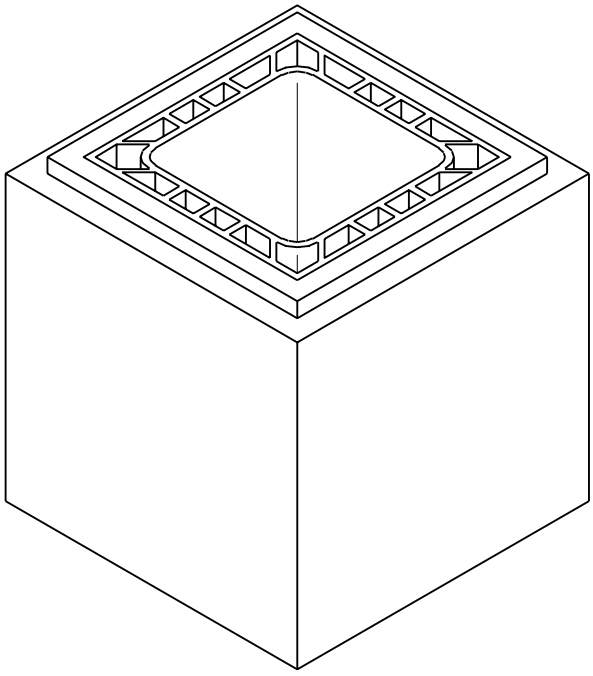


**Figure 5 — Example of flue block with attached insulation**

**3.9**
**nominal size**
numerical designation of size which is a convenient round number equal to or approximately equal to either:

— the internal diameter in millimetres of flue blocks with circular section flue; or

— the internal width in millimetres of flue blocks with square section flue; or

— the internal width and breadth in millimetres of the internal transverse dimensions of flue blocks with rectangular section flue.

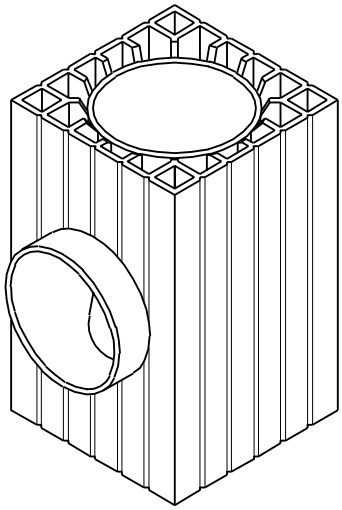


**Figure 6 — Example of entry flue block**

**3.10**
**non-bonding flue block**
flue blocks designed not to be built into a masonry wall with a bonding extension

**3.11**
**straight flue block**
flue blocks designed to be used in a vertical section of a chimney having the ends perpendicular to the axis of the flue (see Figure 1).

**3.12**
**transfer flue block**
flue block which changes the cross-section of the flue from rectangular to circular (see Figure 3).

## 4 Types of flue blocks

Clay/ceramic flue blocks shall be designated according to Clause 19.

A non-exhaustive list of abbreviated designation for clay/ceramic flue blocks, according to temperature, pressure, sootfire resistance and condensate resistance (wet and dry conditions) is given in Table 1.

**Table 1 — Examples of abbreviated designation for clay/ceramic flue blocks, conditions of use, air test pressures and maximum air permeability rates after thermal testing**

| Type | Block type | Temperature | | Negative pressure | Soot fire resistance | Wet or dry conditions | Test pressure | Maximum air leakage rate |
|---|---|---|---|---|---|---|---|---|
| | | working °C | test °C | | | | Pa | $m^3 .s^{-1}.m^{-2} x10^{-3}$ |
| 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 | 300 | 350 | N2 | No | Dry | 20 | 3 |

NOTE A flue block may be designated in one or more types provided that it complies with the appropriate requirements of each type.

# 5 Materials

## 5.1 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.

## 5.2 Insulation

### 5.2.1 General

All information on reaction to fire shall be made available according to the relevant European product standard.

#### 5.2.2 Shape

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

#### 5.2.3 Thermal conductivity of insulation

The manufacturer shall declare the thermal conductivity of the insulation in accordance with the relevant European product standard.

#### 5.2.4 Resistance to heat

When tested in accordance with 18.8.2.3, 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.

## 6 Tolerances on dimensions

### 6.1 Internal transverse dimensions

When tested in accordance with 18.1, the internal diameter of flue blocks with circular section flue 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 section flue, all dimensions shall not deviate more than ± 3 % of the manufacturer's stated nominal internal length of the side. Corners of the flue may be rounded.

### 6.2 Height

When tested in accordance with 18.2, 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.

### 6.3 Angles

When tested in accordance with 18.3, the angle between the axes of a flue block and an angle flue block or between the axes of a transfer flue block shall not be greater than 45° and shall not deviate more than ± 5º of the manufacturer's stated nominal value.

### 6.4 Straightness

When tested in accordance with 18.4, the permissible deviation from straightness of straight flue blocks shall be 1 % of the test length.

### 6.5 Squareness of ends

When tested in accordance with 18.5, the permissible deviation from square of the ends of straight flue blocks shall be not greater than an angle of slope 30 mm/m.

### 6.6 Squareness of angles and flatness of walls

When tested in accordance with 18.6, 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.

### 6.7 Joints

The design and dimensions of the joints shall be as specified by the manufacturer.

### 6.8 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).

### 6.9 Tolerance on insulation thickness

The thickness of factory-fitted insulation on the outer walls of flue blocks shall not be less than the nominal value declared by the flue block manufacturer.

## 7 Proof load

### 7.1 Straight flue blocks

When tested in accordance with 18.7, straight flue blocks shall withstand an intensity of loading of 10 MN/m$^2$.

### 7.2 Angle flue blocks

Where angle flue blocks are fired in a plant alongside straight flue blocks, using the same materials and firing process, the proof load of these angle flue blocks is deemed to be that of the straight flue blocks when tested in accordance with 18.7.

If angle flue 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 flue blocks, shall be tested for compliance with the requirements of 7.1.

### 7.3 Minimum load for inspection opening sections

When tested in accordance with 18.7, the minimum load shall be as given in Table 2.

**Table 2 — Minimum load**

| **Height of chimney** m | **Minimum load** kN |
|---|---|
| $H \leq 12{,}5$ | 25 |
| $12{,}5 < H \leq 25$ | 50 |
| $25 < H \leq 50$ | 100 |

For flue blocks with internal section greater than 0,04 m$^2$ the following equation shall be used:

$$F = \chi \,.\, H \,.\, G/\,100 \qquad (1)$$

where

$F$ is the minimum load in kN;

$\chi$ is the safety factor equal to 5;

$H$ is the height of chimney in m;

$G$ is the weight per metre in kg/m.

### 7.4 Adhesion between outer wall and insulation

When tested in accordance with 18.14, the force required to separate the outer wall from the insulation shall be greater than 500 N.

## 8 Gas tightness and thermal shock resistance

### 8.1 Straight flues blocks

#### 8.1.1 General

The flue blocks shall be assembled in accordance with 18.8.2.

#### 8.1.2 Initial gas tightness

When tested in accordance with 18.8.4, the leakage rate, before thermal shock testing, shall not be greater than $2 \times 10^{-3}.m^3.s^{-1}.m^{-2}$ of internal surface area tested at a differential pressure of (40 ± 2) Pa.

If the permeability rate is exceeded the test flue shall be examined and the joint re-made if necessary or the flue bocks replaced. The leakage rate shall be re-measured after further drying.

#### 8.1.3 Thermal shock resistance

The flue blocks shall be tested in accordance with 18.8.3.

#### 8.1.4 Final gas tightness after thermal shock testing

Flue blocks shall have a leakage rate after thermal shock testing not greater than the values given in Table 3 for the appropriate flue block designation.

**Table 3 — Pressure classes**

| Pressure class | Maximum leakage rate $m^3.s^{-1}.m^{-2}$ | Test pressure Pa |
|---|---|---|
| N 1 | $2 \times 10^{-3}$ | 40 |
| N 2 | $3 \times 10^{-3}$ | 20 |
| P 1 | $0{,}006 \times 10^{-3}$ | 200 |
| P 2 | $0{,}120 \times 10^{-3}$ | 200 |

### 8.2 Angle flue blocks

Where angle flue blocks are fired in a plant alongside straight flue blocks, using the same materials and firing process, the gas tightness and the thermal shock resistance of these angle flue blocks are deemed to be those of the straight flue blocks.

If angle flue 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 flue blocks, shall be tested for compliance with the requirements of 8.1.

## 9 Condensate resistance

When tested in accordance with 18.13, straight flue blocks (for flue blocks operating in wet conditions) shall not allow more than 2,0 g of water per hour per $m^2$ to pass through the internal surface of the test assembly and shall be designated W according to Clause 4.4 of EN 1443:2003 (e.g. FB3, FB4, FB5, etc.).

Flue blocks which do not pass the test and those which are not tested shall be designated D (e.g. FB1, FB2, FB6 etc.).

## 10 Corrosion resistance

When tested in accordance with 18.9, the mass loss from any test piece shall not exceed 2 % for flue blocks designated condensate resistant (W, e.g. FB3, FB4, FB5 etc.) and 5 % for flue blocks working under dry conditions (designated D, e.g. FB1, FB2, FB6 etc.), the flue blocks shall be designated 3 as given in Table 2 of EN 1443:2003.

**Table 4 — Corrosion resistant classes**

| Corrosion resistance class | 1<br>possible fuel types | 2<br>possible fuel types | 3<br>possible fuel types |
|---|---|---|---|
| - gas | Gas : sulphur-content ≤ 50 mg/$m^3$,<br>natural gas L + H | Gas<br>natural gas L+H | Gas<br>natural gas L + H |
| - liquid | Kerosene : sulphur-content ≤ 50 mg/$m^3$ | Oil : sulphur-content ≤ 0,2 %<br>kerosene: sulphur-content ≥ 50 mg/$m^3$ | Oil : sulphur-content > 0,2 %<br>Kerosene : sulphur-content ≥ 50 mg/$m^3$ |
| - wood | - | Wood in open fire places | Wood in open fire places<br>Wood in closed stoves |
| - coal | - | - | Coal |
| - peat | - | - | Peat |

NOTE Class 3 is better than class 2 which is better than class 1.

## 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 18.10, the mean water absorption of five test specimens from new production of flue blocks shall not vary more than ± 2,5 from the mean value obtained from the last type test.

### 11.3 Bulk density

When tested in accordance with 18.11, the mean bulk density of five test specimens from new production of flue blocks shall not vary more than ± 100 kg/$m^3$ from the mean value obtained from the last type test.

## 12 Abrasion resistance

When tested in accordance with 18.12, the mass of any material dislodged shall not exceed 0,03 kg/m$^2$ of the total exposed area of the inner surface of the flue.

## 13 Flow resistance

The mean roughness of flue blocks is 0,0015 m according to EN 13384-1. Other values may be declared and shall be determined in accordance with Annex A.

## 14 Thermal resistance

The values of thermal resistance of flue blocks shall be declared in accordance with Annex B.

## 15 Resistance to fire

### 15.1 Internal to external

#### 15.1.1 Testing at normal operating conditions

The flue block which forms part of a multi-wall chimney shall not be tested for the distance to combustible materials.

The flue block that forms a chimney shall be tested for the distance to combustible materials. For the latter, the distance to combustible material shall be declared in accordance with 18.8. The manufacturer may declare a distance to combustible material that reflects installation practice in individual member states' regulations. The surface temperature of the combustible material shall be equal to or less than 85 °C for an ambient air temperature of 20 °C.

#### 15.1.2 Soot fire test

The flue block which forms part of a multi-wall chimney shall not be tested for the distance to combustible materials.

The flue block that forms a chimney shall be tested for the distance to combustible materials. For the latter, the distance to combustible material shall be declared in accordance with 18.8. The manufacturer may declare a distance to combustible material that reflects installation practice in individual member states' regulations. The surface temperature of the combustible material shall be equal to or less than 100 °C for an ambient air temperature of 20 °C.

NOTE This distance should not be less than the distance under normal operating conditions.

### 15.2 External to external

For complete chimneys which convey products of combustion to the atmosphere, the resistance to fire external to external shall be evaluated according to the provision valid in the intended place of use of the flue blocks until a European test method is available.

## 16 Resistance to freeze/thaw

When subject to regulation, the freeze/thaw resistance of the flue block shall be tested according to EN 14297. The product shall not present any damage of type 7, 8, 9 and 10 in accordance with EN 14297:2004, Table 1.

# 17 Evaluation of conformity

## 17.1 General

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

— initial type testing;

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

For the purposes of testing, the flue blocks may be grouped into families, where it is considered that the selected property/properties is/are common to all the flue blocks within that family.

## 17.2 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 for each requirement.

All thermal testing shall be carried out on one size of flue blocks for each geometrical configuration, e.g. circular, square, rectangular. For circulars flue blocks the size to be tested shall be 200 mm internal diameter or the closest available internal diameter from the product range. For other geometric configurations the flue blocks shall have an equivalent hydraulic diameter.

When a change is made either in material composition, processing technique or to the design of the flue block, the initial type tests shall be carried out.

## 17.3 Further tests

They may be performed more frequently by incorporation into a plant for monitoring the consistency of manufacture and in particular the characteristics subject to the initial type testing.

## 17.4 Factory production control

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

Factory production control tests are carried out following manufacture to monitor the quality of product (see Table 5).

**Table 5 — Initial type tests and factory production control**

| Item | Relevant requirements clauses | |
|---|---|---|
| | Initial type testing | Factory production control |
| | 17.2 | 17.4 |
| **Straight flue blocks** | 7.1,8, 9, 10, 13,12, 14, 15 and 16 | 6.1, 6.2, 6.4, 6.5, 6.6 and 11 |
| **Angle blocks** | 7.2, 8.2, 10 and 16 | 6.1, 6.3, and 11 |

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 C).

Batches rejected under the sampling procedure specified above 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 EN ISO 9001 and Clause 17 are complied with.

# 18 Test methods

## 18.1 Internal transverse dimensions

For flue blocks with square or rectangular section flue the maximum and minimum width/breadth shall be those calculated from the tolerances given in 6.1.

For flue blocks with circular section flue, the maximum and minimum diameters shall be those calculated from the tolerances given in 6.1.

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

Both ends of the flue blocks shall be measured.

## 18.2 Height

The maximum and minimum internal heights of a clay/ceramic flue block shall be those calculated from the tolerances given in 6.2. If direct measurement is to be carried out, take two measurements at the maximum and minimum heights.

The test also may be carried out by using two gauges whose heights are set at the minimum and maximum internal heights. The minimum gauges shall be not able to fit over the internal height of the flue block. The maximum gauge shall be able to fit over the internal height of the flue block.

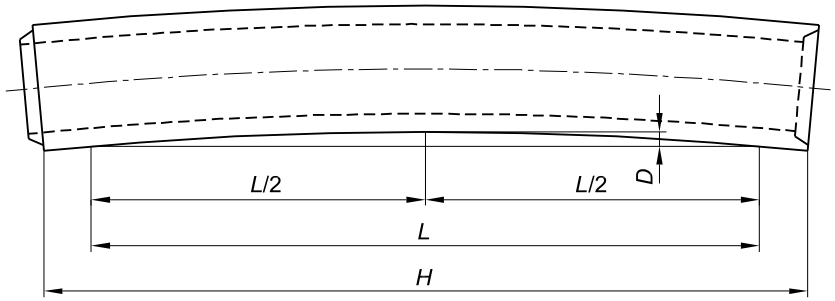
## 18.3 Angles

The maximum and minimum angles between the axises of the flue block and the angle flue block or between the axes of the transfer flue block shall be those calculated from the tolerances given in 6.3. Direct measurement of the angles shall be carried out.

## 18.4 Straightness

The deviation from straightness of a flue block is the maximum distance from the centre of a straight line equal to the test length spanning any concave curve on the outside of the flue block to the flue block surface (D) as shown in Figure 7. It is permissible to test for straightness using any suitable apparatus.

The test length shall be 50 mm less than the nominal height of the flue block to allow for clearance at the shoulder of any socket.




**Key**

*H* Nominal height of the flue block in mm

*L* Test length of the flue block in mm

*D* Deviation from straightness in mm

*H* - *L* = 50 mm

**Figure 7 — Terms for deviation from straightness**

## 18.5 Squareness of ends

### 18.5.1 Gauge test

The test gauge as shown in Figure 8 with one arm set at a slope of 30 mm/m to the other shall be provided with two pairs of supports at (50 ± 5) mm centres. The end support shall be positioned so that there is a recess of at least 30 mm from the inside of the angled arm. The slope of the supports shall be such as to provide a clearance of at least 5 mm under the test gauge. The angled arm shall be of such a length as to span the outside diameter/width of the flue block.

The gauge shall be placed on the end of the flue block, at the line of the longest external measurement of the flue block. The slope of the end shall be checked against that of the gauge.

Dimensions in millimetres

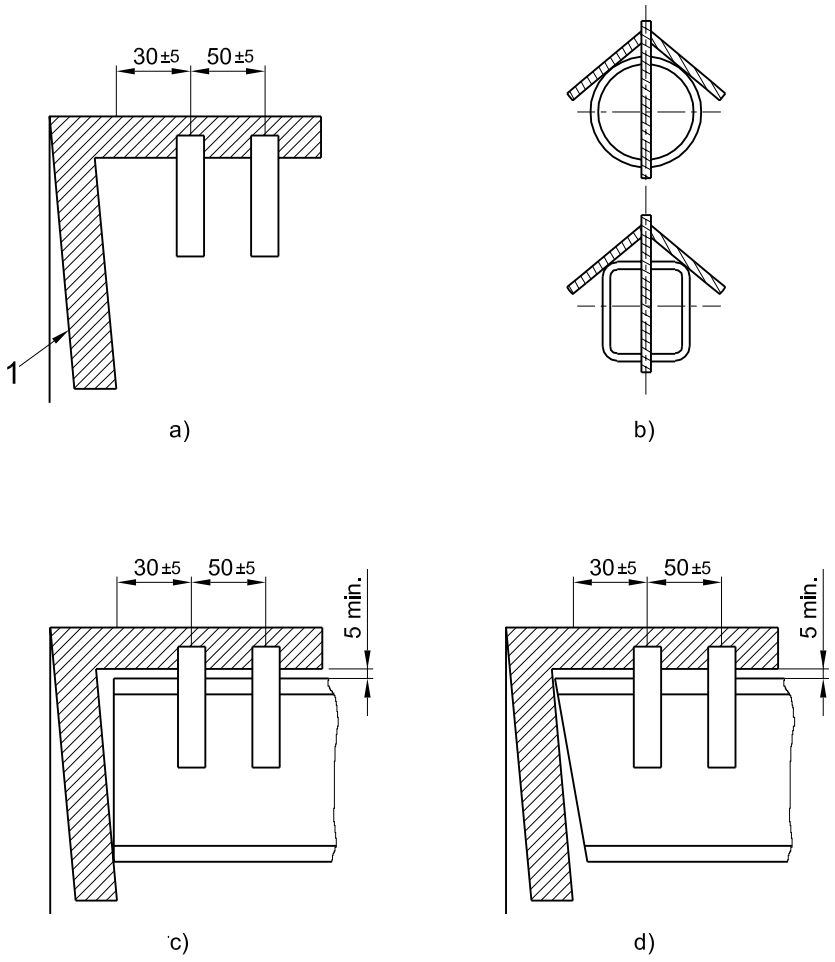



**Figure 8 — Squareness test for ends**

**Key**

1 30 mm/m slope
*a* Longitudinal section of gauge
*b* Cross-section of gauge
*c* Flue block passing test
*d* Flue block failing test

### 18.5.2 Direct measurement test

The flue block shall be placed upright on the flat plate.

A set square shall be applied on the outside of the flue block, at the inferior extremity (see Figure 9).

The horizontal distance (*d*) shall be measured at an accuracy of ± 0,5 mm.

The slope is given by the formula:

$$\text{Slope} = 1\,000\ d/H \text{ (mm/m)} \qquad (2)$$

$H$ is the height of the flue block in millimetres.

Repeat the measurement with the flue block on the other side.

NOTE The joint section does not have to be taken into account.

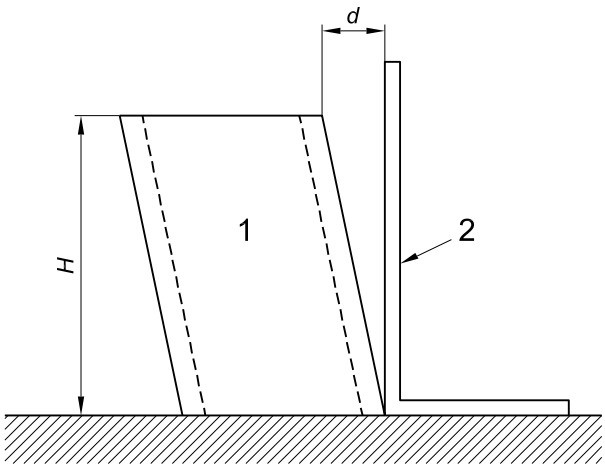


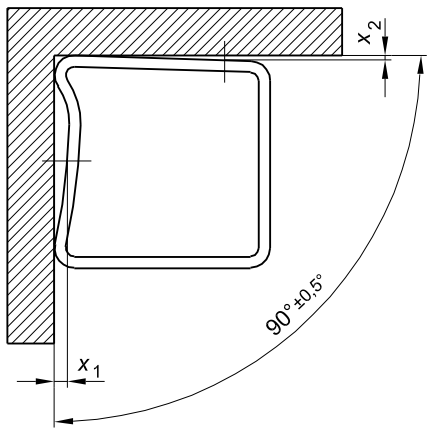

**Figure 9 — Squareness test for ends**

**Key**

*d* Horizontal distance in mm
*H* Height of the flue block in mm
1 Flue block
2 Set square

## 18.6 Squareness of angles and flatness of walls

The test gauge shall be as shown in Figure 10 with one arm set at an angle of (90 ± 0,5)° to the other and both arms of the test gauge of such a length as to span the outside width of the flue block under test.




**Key**

$X_1$ Deviation from flatness of the wall in mm
$X_2$ Deviation from squareness of the wall in mm

**Figure 10 — Squareness test for angles and flatness of walls**

The gauge shall be placed against two adjoining walls of square or rectangular straight flue blocks and the distances $X_1$ and $X_2$ measured between the inner edge of the test gauge and the outside of the flue block, excluding the rounded external corners, to an accuracy of ± 0,5 mm.

The percentage deviation from flatness shall be calculated as:

$$\frac{X_1 \times 100}{L_{X_1}} \tag{3}$$

The percentage deviation from squareness shall be calculated as:

$$\frac{X_2 \times 100}{L_{X_2}} \tag{4}$$

where

$L_{x1}$ is the manufacturer's stated nominal internal length of the wall against which $X_1$ is measured in mm

$L_{x2}$ is the manufacturer's stated nominal internal length of the wall against which $X_2$ is measured in mm

## 18.7 Proof load

### 18.7.1 Test sample

The test specimen shall be cut from a flue block and shall not include any part of a joint. The test specimen shall not be less than 150 mm high with flat and parallel ends on the full cross section of the flue block.

### 18.7.2 Testing equipment

The testing machine shall be substantial and rigid throughout so that the distribution of load will not be affected appreciably by the deformation or yielding of any part. The machine shall be capable of applying the load at the rate specified in 18.7.3 and its accuracy shall be verified by the means detailed in ISO 7500-1.

The bearing faces of both the thrust packers and the thrust plates shall be larger than the outside dimensions of the flue block under test.

The thrust plates shall consist of metal, free from warping or twisting and be centrally located and of sufficient dimensions so as not to distort under load. One thrust plate shall be free to tilt in any direction so that it may align with the surface of its associated thrust packer.

The thrust packers shall consist of $(18 \pm 2)$ mm thick moisture resistant flooring grade chipboard according to EN 312 which shall be flat pressed with the surface as pressed and be concentric with the thrust plates. New thrust packers shall be used for each test.

The test specimen shall be placed in the machine so that the load is applied through its longitudinal axis.

### 18.7.3 Procedure

Ensure that the bearing surfaces of the machine and test specimen are clean and free from any loose particles.

Place the test specimen, together with a thrust packer at each end, between the thrust plates. Place the test specimen in the machine so that the load is applied through its longitudinal axis.

Apply the load to the test specimen without shock and increase at a maximum rate of 14 MN/m$^2$ per minute until the required intensity of loading as specified in 7.1 is reached.

The proof load required to produce the specified intensity of loading shall be calculated by one of the following methods, as appropriate to the type of flue block:

**i) For circular flue blocks**

$$\text{Proof load } (N) = \frac{10{,}0\ \pi \left( D_1^2 - D_2^2 \right)}{4} \qquad (5)$$

where

$D_1$ is the mean external diameter of the test piece, in millimetres;

$D_2$ is the mean internal diameter of the test piece, in millimetres.

**ii) For square flue blocks**

$$\text{Proof load } (N) = 10{,}0\ (W_1^2 - W_2^2) \qquad (6)$$

where

$W_1$ is the mean external width of the test piece (excluding rounded corners), in millimetres;

$W_2$ is the mean internal width of the test piece (excluding rounded corners), in millimetres.

**iii) For rectangular flue blocks**

$$\text{Proof load } (N) = 10{,}0\ (L_1 \times B_1 - L_2 \times B_2) \qquad (7)$$

where

$L_1$ is the mean external width of the cross-section of the test piece (excluding rounded corners) in mm;

$B_1$ is the mean external breadth of the cross section of the test piece (excluding rounded corners in mm;

$L_2$ is the mean internal width of the cross section of the test piece (excluding rounded corners) in mm;

$B_2$ is the mean internal breadth of the cross section of the test piece (excluding rounded corners) in mm.

**iv) For flue blocks with vertical perforations**

$$\text{Proof load } (N) = 10{,}0\ A \qquad (8)$$

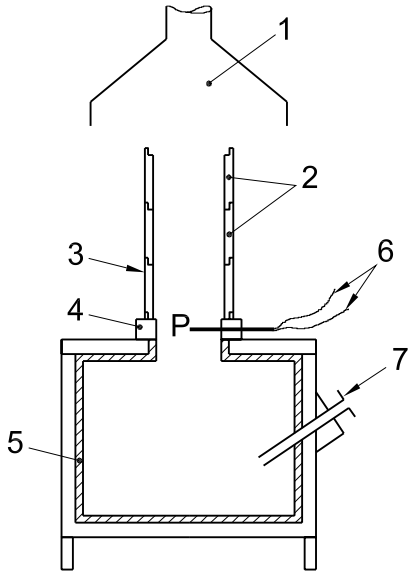
where

$A$ is the net cross-sectional area of flue blocks in square millimetres (i.e. measured by hydrostatic weighing).

## 18.8 Thermal performance tests

### 18.8.1 Test equipment

An example of equipment suitable for heating the flue is shown in Figure 11.




**Key**

1 Exhaust gas canopy
2 Test flue
3 Outlet
4 Refractory collar
5 Ceramic fibre
6 Thermocouple
7 Gas burner

**Figure 11 — Example of hot air generator**

The box furnace should be heated by a high-velocity gas burner where combustion is essentially completed within the burner body. The burner should be angled downwards so that the hot gases do not impinge directly onto the exhaust port in the roof of the furnace. The burner should be fired by a gaseous fuel (natural gas, propane or butane). The maximum rated capacity of the burner shall not be less than 150 kW.

An alternative source of heat may be used provided the same heating conditions apply.

In order to obtain the required rate of heating, construct a light-weight furnace, i.e. low thermal mass. Typically, the internal dimensions of the box furnace are 700 mm long x 700 mm deep x 700 mm high and the box is lined with 100 mm of ceramic fibre. The burner shall be placed centrally on one side of the box furnace.

The exhaust port shall be fitted with a collar of cast refractory concrete with an opening of the same shape as the internal cross-section of the flue.

The temperature of the products of combustion shall be measured by a Type K (Nickel-Chromium/Nickel-Aluminium) thermocouple with an unsheathed junction located in the centre of the opening at the base of the test flue. The gas and air supply to the burner shall be adjustable and a gauge shall be fitted to measure the volume flow rate of air supplied.

### 18.8.2 Test flue

#### 18.8.2.1 General

Prior to assembly the test specimens shall be dried to constant mass at a temperature of (110 ± 5) °C.

Construct a test flue of flue blocks to give a minimum overall height of 2 m.

The joint between the test flue blocks shall be made using a mortar in accordance with the flue block manufacturer's instructions for the appropriate temperature class.

After construction, the test flue shall be left at ambient temperature 15 °C to 30 °C for a minimum period of 14 days to allow the mortar to cure or in accordance with the manufacturer's instructions for the mortars.

#### 18.8.2.2 Resistance to fire, internal to external

Either:

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

b) install the test flue as shown in Figure 12 adjacent to the combustible partition having a thermal resistance of at least 0,04 ($m^2$.K)/W at 100 °C at the manufacturer's declared distance to combustibles. Seal the opening (side and top, see Figure 12), unless the manufacturer allows the gap to be ventilated.

#### 18.8.2.3 Thermal shock resistance

The next to the last joint shall be made so that the last two flue blocks may be removed for air permeability and abrasion tests.

The test flue shall be installed in a freestanding manner.

### 18.8.3 Procedure

#### 18.8.3.1 General

Deliver completely combusted gas, according to the flow rate in Table 6 into the test flue and raise the temperature of the gas uniformly to the appropriate test temperature (see Table 7) measured at the location determined as described in Figure 11.

**Table 6 — Hot gas volume flow rates test temperature and flue diameter**

**A. Thermal performance – negative pressure chimneys** (volume flow in $m^3/h \pm 10$ %)

Maintain the hot gas temperature at $(0 + 10)$ % of the test temperature up to 500 °C and (0 + 50) °C for higher temperatures

| Diameter (1) mm | Test temperature °C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 120 | 150 | 170 | 190 | 250 | 300 | 350 | 500 | 550 | 700 | 1 000 |
| 80 | 42,1 | 42,9 | 43,9 | 45,1 | 46,3 | 50,2 | 53,7 | 57,2 | 67,4 | 68,2 | 80,6 | 97,9 |
| 100 | 65,8 | 66,9 | 68,5 | 70,4 | 72,3 | 78,5 | 83,9 | 89,3 | 105 | 110 | 126 | 153 |
| 125 | 102 | 104 | 107 | 110 | 113 | 123 | 132 | 140 | 164 | 172 | 197 | 239 |
| 150 | 148 | 150 | 154 | 159 | 163 | 177 | 189 | 201 | 237 | 238 | 283 | 344 |
| 175 | 201 | 205 | 210 | 216 | 221 | 240 | 257 | 274 | 322 | 338 | 386 | 468 |
| 200 | 263 | 266 | 274 | 282 | 289 | 314 | 337 | 357 | 421 | 439 | 504 | 612 |

**B. Thermal performance – positive pressure chimneys** (volume flow $m^3/h \pm 10$ %)

Maintain the hot gas temperature at $(0 + 10)$ % of the test temperature up to 500 °C and (0 + 50) °C for the higher temperatures

| Diameter (1) mm | Test temperature °C | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 120 | 150 | 170 | 190 | 250 | 300 | 350 | 500 | 550 | 700 | |
| 50 | 22,0 | 22,8 | 24,0 | 25,0 | 26,0 | 28,0 | 30,0 | 32,0 | 37,0 | 38,8 | 44,1 | |
| 80 | 64,0 | 66,0 | 69,0 | 72,0 | 74,0 | 80,0 | 85,5 | 91,0 | 107 | 112 | 126 | |
| 100 | 105 | 109 | 115 | 119 | 122 | 133 | 142 | 151 | 177 | 185 | 209 | |
| 125 | 174 | 180 | 189 | 196 | 202 | 220 | 235 | 249 | 292 | 305 | 345 | |
| 150 | 262 | 271 | 285 | 295 | 304 | 331 | 353 | 375 | 440 | 460 | 520 | |
| 175 | 370 | 383 | 404 | 417 | 430 | 468 | 500 | 531 | 622 | 651 | 736 | |
| 200 | 500 | 518 | 545 | 564 | 580 | 632 | 675 | 717 | 840 | 879 | 994 | |

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

(1) For square and rectangular section, the diameter is calculated by the following calculation:

$$D_h = \frac{2 \cdot W \cdot L}{W + L}$$

where

$D_h$ is the hydraulic diameter in mm

$W$ is the width in mm;

$L$ is the length in mm.

#### 18.8.3.2 Resistance to fire, internal to external

For the test assembly described in 18.8.2.2.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 test flue 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 assembly described in 18.8.2.2.b) additional points of measurement shall be on the faces of the combustible partition at a location opposite to the mid point of the test flue.

##### 18.8.3.2.1 Normal operating condition

The temperature of the gas shall be raised at the appropriate test temperature (see Table 7) within $(10 \pm 1)$ min then maintained 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.

Determine the maximum temperature at the points of measurement for an ambient air temperature of 20 °C.

**Table 7 — Test temperature**

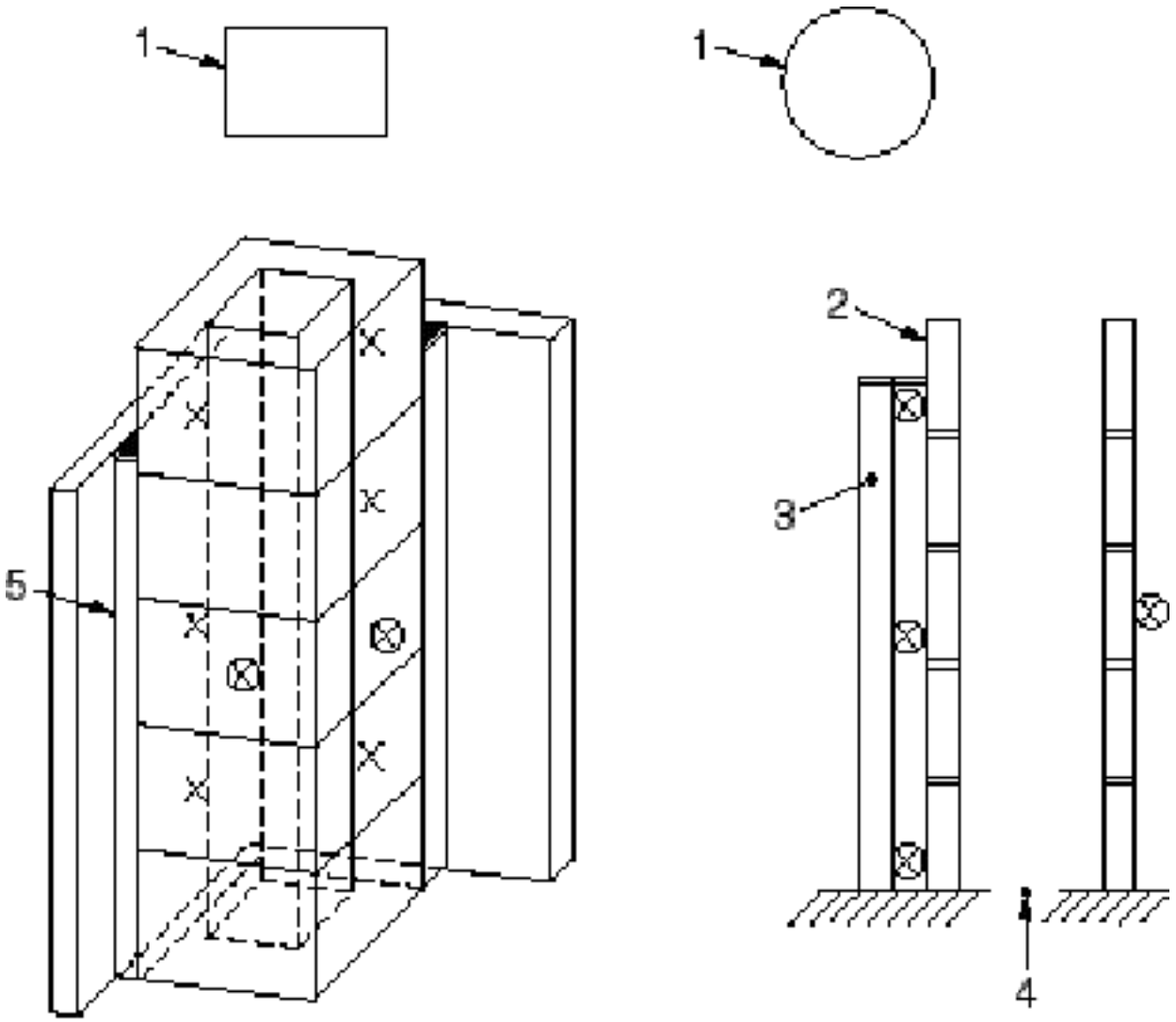
| Temperature class | T080 | T100 | T120 | T140 | T160 | T200 | T250 | T300 | T400 | T450 | T600 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Test temperature °C | 100 | 120 | 150 | 170 | 190 | 250 | 300 | 350 | 500 | 550 | 700 |

#### 18.8.3.2.2 Soot fire condition

The thermal test under normal operating conditions shall be carried out before the following test, when relevant.

The temperature of the gas shall be raised at 1000 °C ($^{+50}_{0}$) °C within (10 ± 1) min then maintained for a period of (30 ± 1) min.

Determine the maximum temperature of the points of measurement for an ambient air temperature of 20 °C.




**Key**

1 Location of the hot gas thermocouple
2 Flue blocks
3 Partition
4 Hot gas temperature measurement point
5 Seal
⊗ Partition temperature
X Outer wall temperature

**Figure 12 — Example of test assembly**

#### 18.8.3.3 Thermal shock resistance

The temperature of the gas shall be raised at the appropriate test temperature according to the flue block designation (see Table 8) then maintained for a period of 30 min.

After heating, the test flue shall be allowed to cool to room temperature without forced ventilation and with the thermal insulation retained in position.

**Table 8 — Test temperature and time to test temperature**

| Temperature class | Test temperature<br>°C | Time to reach the test temperature from start of heating<br>min ± 10 % |
|---|---|---|
| Soot fire resistant (G) | 1 000 | 10 |
| T600 | 700 | 7 |
| T450 | 550 | 5,5 |
| T400 | 500 | 5 |
| T300 | 350 | 3,5 |
| T250 | 300 | 3 |
| T200 | 250 | 2,5 |
| T160 | 190 | 1,9 |
| T140 | 170 | 1,7 |
| T120 | 150 | 1,5 |
| T100 | 120 | 1,2 |
| T80 | 100 | 1 |

### 18.8.4 Measurement of permeability rate

For permeability testing before and after subjecting the test flue to a thermal shock test, a fan or other device capable of producing at least the required differential pressure, a flow meter and a manometer shall be used.

When the flue has cooled, after thermal shock testing, determine the permeability at the differential pressure given in Table 3 as appropriate to the type of flue block.

The test flue shall be sealed and the flue connected to a suitable fan or other device. The delivery of air at ambient temperature 15 °C to 30 °C from the fan shall be controlled to maintain the required differential pressure measured in the flue. The volume of air being delivered to the flue over one minute shall be measured and the permeability rate calculated in terms of $m^2$ internal surface area of test flue.

#### 18.8.4.1.1 Expression of results

The permeability rate at the specified test pressure shall be expressed in terms of $m^3$ of air per second per $m^2$ of internal cross-sectional area of test [$m^3.s^{-1}$ $m^{-2}$].

## 18.9 Corrosion resistance test

### 18.9.1 Test specimens

The test specimens shall be six freshly broken pieces of flue blocks or the inner wall of a flue block with vertical perforations about (50 x $10^3$) $mm^3$ ± (10 x $10^3$) $mm^3$ in volume free from cracks or shattered edges.

Measure first the thickness *E* of the test specimen (correct to ± 1,0 mm).

The plan area of test specimen equals approximately $\frac{5\ 0000}{E}$ $mm^2$ (9)

The length of side for a square sided test specimen equals approximately $\sqrt{\frac{50\,000}{E}}$ $mm^2$ (10)

EXAMPLE

Wall thickness of flue block equal to 12 mm

Plan area $\frac{50000}{12}\text{mm}^2 = 4167\ \text{mm}^2$

Length of side $\sqrt{4167}\ \text{mm} \approx 65\ \text{mm}$

### 18.9.2 Test equipment

A ventilated oven capable of maintaining a temperature of 110 °C ± 5 °C.

A balance with an accuracy of (± 0,01 g) when loaded with 200 g.

A boiling water bath.

A 2 litre beaker.

Supply of de-mineralized water.

Sulfuric acid solution, c[$H_2SO_4$] = 70 % by mass [density at 20 °C =1,610 kg/$m^3$].

Barium chloride drops [concentration 50 g per litre].

### 18.9.3 Procedure

Clean the test specimens in de-mineralised water using a soft brush to remove any loose particles and dry at a temperature of 110 °C ± 5 °C until no further loss of mass (± 0,1 g) is noted on successive weighings at 24 hour intervals. The dry weight of the test specimen shall be recorded in grams ($M_1$).

Place the dried test specimens in a 2 l beaker and immerse for 6 h ± 0,1 h in 1,5 l of sulfuric acid solution. Cover the beaker with a watch glass to limit evaporation of the acid. During this time, stand the beaker in a bath of gently boiling water.

On removal from the acid solution, place the test specimen in a beaker and wash by immersion in de-mineralised water for 30 min, heat the water to boiling in 15 min and hold at boiling for a further 15 min.

Test for the presence of sulfate on a test-tube test specimen. Take the test specimens from the rinsing bath. Add several drops of a barium chloride solution to the de-mineralised water at the rate of 50 g per litre.

Repeat the washing cycle, changing the rinsing water after each cycle, until the water no longer becomes turbid when a few drops of barium chloride are added or a maximum of 100 washing cycles [approximately 50 hours of rinsing].

Wash the test specimens and dry at a temperature of 110 °C ± 5 °C until no further loss of mass (± 0,01 g) is noted on successive weightings. Record the final dry weight of the test specimen in grams ($M_2$).

#### 18.9.4 Expression of results

The loss of acid soluble matter in each of the test pieces shall be calculated as a percentage of the dry mass as follows :

Percentage loss in dry mass:

$$\frac{M_1 - M_2}{M_1} x100 \qquad (11)$$

### 18.10 Water absorption

#### 18.10.1 Test specimen

The test specimen shall be a test specimen of the flue block having a dry mass of between 0,25 kg and 0,4 kg.

#### 18.10.2 Test equipment

A ventilated oven capable of maintaining a temperature of 110 °C ± 5 °C.

A balance with an accuracy of (± 0,1 g).

A boiling tank with a capacity to immerse the whole test specimen in water. The tank shall be fitted with a grid on which to support the test specimen to ensure free circulation of water around all surfaces of the test specimen.

A desiccator containing silica gel or a more active desiccant.

#### 18.10.3 Procedure

Dry the test specimen in a ventilated oven at a temperature of (110 ± 5) °C until no loss of mass (± 0,1 g) is noted on successive weightings at 24 h intervals. Determine the mass in grams ($W_1$) after cooling the test specimen to room temperature in a desiccator containing a desiccant.

Place the dry test specimen in water at ambient temperature. Bring the water to the boil and maintain at boiling point for one hour, immerse all the test specimen during this period. After the end of boiling, leave the test specimen immersed in the water for a further four hours. Remove the test specimen from the tank, remove surface water by wiping with a damp cloth and weigh the test specimen in grams immediately ($W_2$).

#### 18.10.4 Expression of results

The water absorption of the test specimen shall be determined as the ratio of the increase in mass of the saturated test specimen to the mass of the dry test specimen. The ratio shall be expressed in percentage terms to the nearest 0,1 %.

$$\frac{W_2 - W_1}{W_1} x100 \qquad (12)$$

## 18.11 Bulk density

### 18.11.1 Test specimen

A test specimen shall be a test specimen of the flue block having a dry mass of between 0,25 kg and 0,4 kg.

### 18.11.2 Test equipment

A ventilated oven capable of maintaining a temperature of (110 ± 5) °C.

A balance with an accuracy of (± 0,1 g).

A boiling tank with a capacity to immerse the whole test specimen in water. The tank shall be fitted with a grid on which to support the test specimen to ensure circulation of water around all surfaces of the test specimen.

A bridge to be placed over the load bearing scale pan of the balance.

A container with adequate capacity to freely suspend the whole test specimen submerged in water.

A suspension thread/wire not more than 0,3 mm in diameter.

A desiccator containing silica gel or a more active desiccant.

### 18.11.3 Procedure

Dry the test specimen to a constant mass in a ventilated oven at a temperature of (110 ± 5) °C. Determine the mass in grams ($W_1$) after cooling the test specimen to room temperature in a desiccator containing a desiccant.

Place the dry test specimen in water at ambient temperature.

Bring the water to the boil and maintain at boiling point for one hour, keep all of the test specimen immersed during this period. After the end of boiling, leave the test specimen immersed in the water for a further four hours. Weigh the test specimen freely suspended in water at ambient temperature (20 ± 5) °C ($W_2$ grams).

Remove the test specimen from the water, remove surface water by wiping with a damp cloth and weigh the test specimen immediately ($W_3$). The difference in the two weights in grams ($W_3$-$W_2$) gives the volume of the test specimen in $cm^3$.

### 18.11.4 Expression of results

The dry density of the test specimen shall be determined by dividing the dry mass of the test specimen by the volume (obtained by subtracting the mass of the test specimen when weighed under water from that when weighed in air immediately after immersion). The dry density shall be expressed to the nearest 10 $kg/m^3$.

$$\text{Bulk density} = \frac{W_1}{W_3 - W_2} \times 1\,000\ (\text{kg/m}^3) \qquad (13)$$

## 18.12 Abrasion resistance

### 18.12.1 Test flue

The test flue shall be as specified in 18.8.2.3 and shall have been subjected to thermal shock testing.

### 18.12.2 Test equipment

A tight fitting metal sleeve attached to a catchment funnel shall be fitted into the top opening of the test flue. A tight fitting metal sleeve attached to a plate which has an opening matching the area of the opening of the flue block shall be fitted into the bottom opening of the test flue, as shown in Figure 13.

The bottom plate shall be supported directly over a collection box positioned to collect any material which is dislodged during the test, and which is of sufficient depth to allow the brush to pass through the complete length of the test flue.

If the test flue is to be weighed, use a balance with an accuracy of (± 1,0 g) capable of weighing two flue blocks.

The sweeping brush shall have flat spring-steel bristles of stainless steel in accordance with EN 10088-1, grade X10 CR NI 18-8, steel number 1.4310, with a cross-section of (2,0 mm ± 0,2) mm x (0,25 ± 0,05) mm with the ends cut square. The bristles shall be arranged so that there are 5 per 10 mm length of the perimeter of the plan area of the brush. The brush may be a combination of single brushes.

The overall dimension of the brush shall be (25 ± 5) mm greater than the internal dimension of the flue, as shown in Figure 14. The brush shall be held securely between plates having a plan dimension (100 ± 5) mm less than the internal dimension of the flue.

The brush shall be attached either to a rod or to sweeping equipment.

### 18.12.3 Procedure

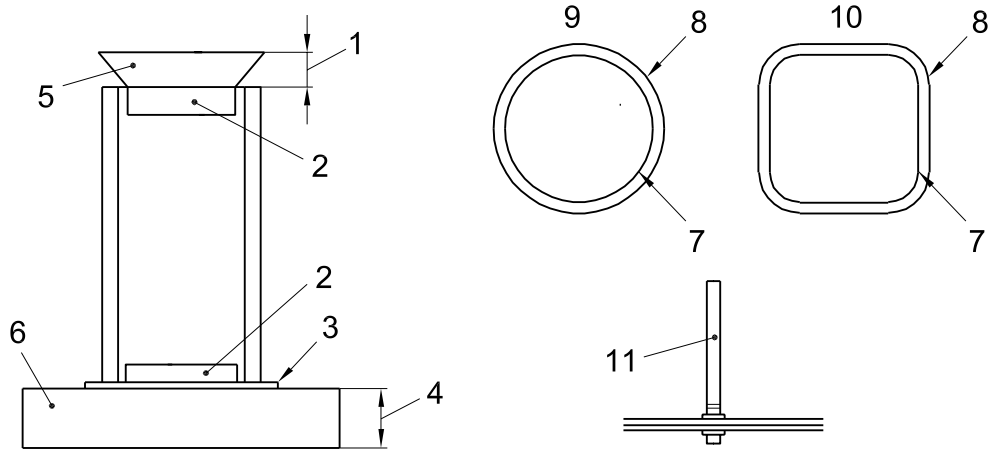
The brush shall be pushed down and up through the total length of the test sample with a maximum speed of 2 m/s and this represents one cycle.

The flue blocks shall be conditioned by carrying out 20 brush cycles. Any material dislodged during this conditioning phase shall be discarded. Carry out a further 80 brush cycles collecting any dislodged material.

Weigh of material dislodged from the inner surface of the test assembly and record.

Calculate the area of the inner surface of the test assembly between the steel sleeves. Calculate the loss of material per $m^2$.

As an alternative measurement procedure, weigh the test flue to (± 1,0 g) after 20 cycles and 100 cycles and record the difference in mass between the two weightings to obtain the mass of material abraded during the test. Calculate the area of the inner surface of the test assembly. Calculate the loss of material per square metre.

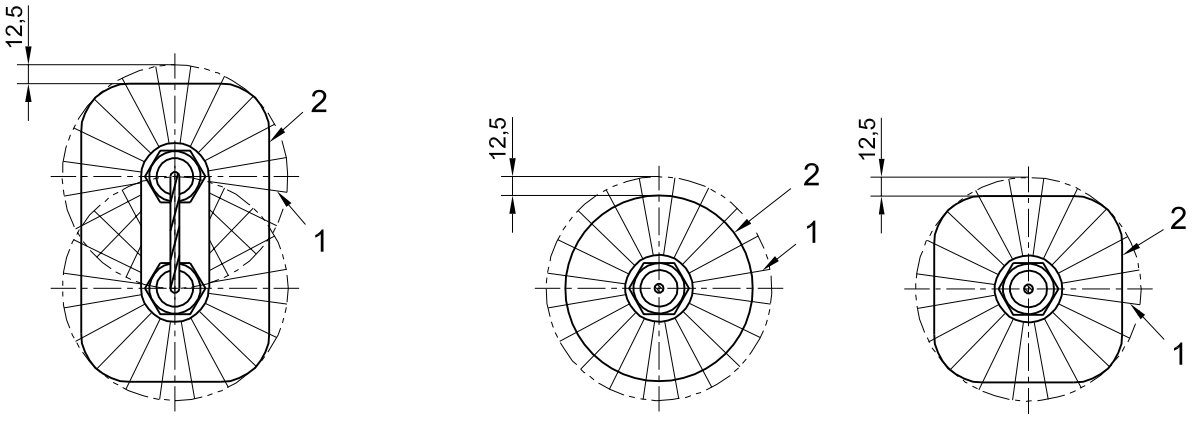



**Key**

1 Height of funnel not less than 200 mm
2 Tight fitting sleeve projecting 20 to 40 mm into opening
3 Bottom plate attached to bottom sleeve
4 Height sufficient to allow brush to pass through bottom of test assembly
5 Catchment funnel attached to sleeve
6 Collection box
7 Plan of flue block opening area
8 Plan of brush area
9 Round flue block
10 Square or rectangular flue block
11 Rod

**Figure 13 — Test assembly for sweeping resistance test**

Dimensions in millimetres




**Key**

1 Brush
2 Flue block cross section: round, square, rectangular

**Figure 14 — Sweeping test equipment**

## 18.13 Condensate resistance test

### 18.13.1 Test section

The test section shall consist of at least two flue blocks and be jointed in accordance with the manufacturer's instructions, with a height ≥ 1,0 m. The internal dimensions shall be (140 ± 10) mm or (200 ± 20) mm or (140 x 140 ± 10) mm or (200 x 200 ± 20) mm or the closest available internal dimensions from the product range. One flue block may be used cut into two pieces.

### 18.13.2 Test apparatus

The test section shall be sealed into an airtight vessel; it shall have internal dimensions 50 mm to 60 mm greater than external dimensions of the test specimen. The test section shall be connected to a humidity generator as shown in Figure 15. Use a fan which will generate an air velocity of (1,0 ± 0,1) m/s and a heat generator capable of keeping the air temperature at (55 ± 2) °C together with a water nozzle capable of vaporizing water to saturation. Use a capillary to ensure the air pressure remains at atmospheric.

### 18.13.3 Procedure

Generate an airflow of 1 m/s ± 10 % with the fan. Spray water through the nozzle into the air stream. Keep the temperature of the saturated air at the entrance of the test section at (55 ± 2) °C under a steady state.

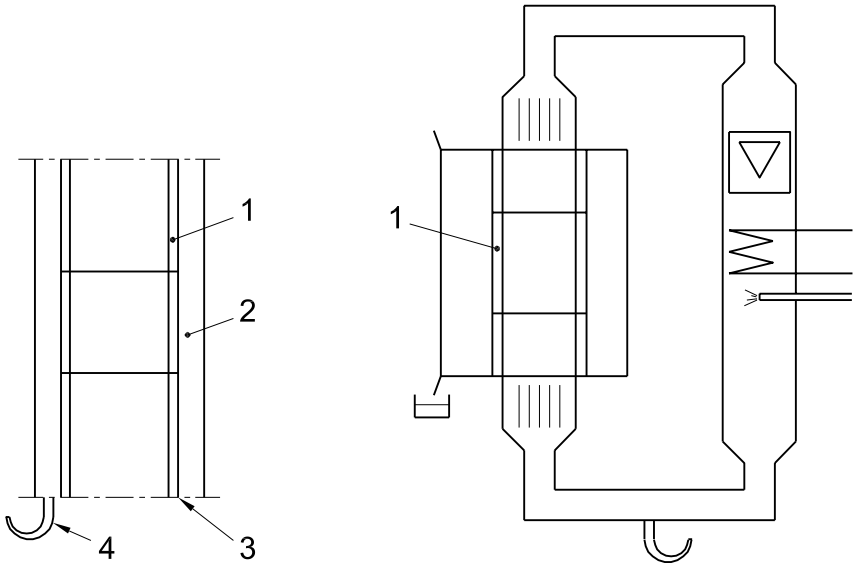
The ambient temperature shall be (25 ± 5) °C throughout the test period.

Collect every (24 ± 0,5) h the water in the annular section between the test flue section and casing.

A steady state condition is deemed to exist when the temperature does not change more than 1 °C in 3 h and the average of the mass of water taken from five measurements shall not vary by more than 1 g when compared with the average of the previous five measurements.

### 18.13.4 Expression of results

Calculate the amount of water passing through the walls of the test flue related to the surface area in 1 h.




**Key**

1 Flue block
2 Casing
3 Sealant
4 Condensate removal

**Figure 15 — Water and vapour flow test vessel and water and vapour flow test apparatus**

## 18.14 Adhesion test for insulation attached to outer wall of flue blocks

### 18.14.1 Test specimen

The test specimen shall be a flue block which has factory-fitted insulation attached. The insulation shall have been attached at least 7 days before testing.

### 18.14.2 Testing procedure

The test procedure shall be as in 18.7.2.

### 18.14.3 Loading

Ensure that the bearing surfaces of the machine and test specimen are clean and free from any loose particles.

The test specimen shall be placed vertically on a thrust packer so that the force is only applied through the insulation and the insulation protection. The thrust packer at the other end shall only exert force on the flue block. This assembly shall be placed between the thrust plates. The test specimen shall be placed in the machine so that the load is applied through its longitudinal axis.

The load shall be applied to the test specimen without shock and increased at a maximum rate of 0,014 $MN/m^2$ per minute until the 500 N is reached.

## 19 Designation

The following shall be used for the designation of flue blocks:

a) Denomination;

b) standard number;

c) nominal size;

d) temperature class;

e) pressure class N or P;

f) resistance to condensate class;

g) corrosion resistance class;

h) Thermal resistance $R$ in $m^2.K/W$;

i) soot fire resistance class G (followed by a distance to combustible material for flue blocks which form a chimney) or O;

j) nominal angle of angle flue block (where applicable);

k) flow resistance.

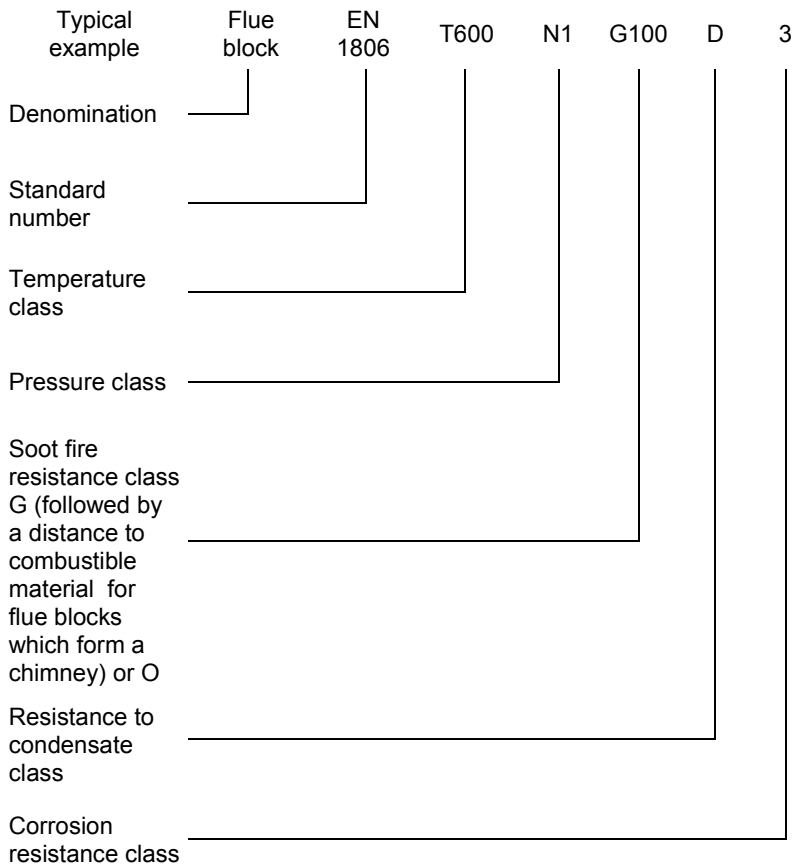


**Table 9 — Example of flue block characteristics annotated according to EN 1443 for the abbreviated designation**

| Type | Block | Type of chimney | Negative pressure | Soot fire resistance | Dry or Wet conditions | Corrosion resistance |
|---|---|---|---|---|---|---|
| FB1 N2 | Non-bonding | T600 | N2 | G | D | 3 |
| FB1 N1 | Non-bonding | T600 | N1 | G | D | 3 |
| FB2 N2 | Non-bonding | T600 | N2 | O | D | 3 |
| FB2 N1 | Non-bonding | T600 | N1 | O | D | 3 |
| FB3 N2 | Non-bonding | T400 | N2 | O | D & W | 3 |
| FB3 N1 | Non-bonding | T400 | N1 | O | D & W | 3 |
| FB4 N2 | Non-bonding | T300 | N2 | O | D & W | 3 |
| FB4 N1 | Non-bonding | T300 | N1 | O | D & W | 3 |
| FB5 N2 | Non-bonding | T200 | N2 | O | D & W | 3 |
| FB5 N1 | Non-bonding | T200 | N1 | O | D & W | 3 |
| FB6 | Bonding | T300 | N2 | O | D | 3 |

Symbols:

N negative pressure;

W wet conditions;

D dry conditions;

O without soot fire resistance;

G with soot fire resistance;

3 high corrosion resistance.

## 20 Marking, labelling and packaging

Flue blocks or packaging shall be marked with:

— EN 1806 (the number of this standard);

— manufacturer's identification;

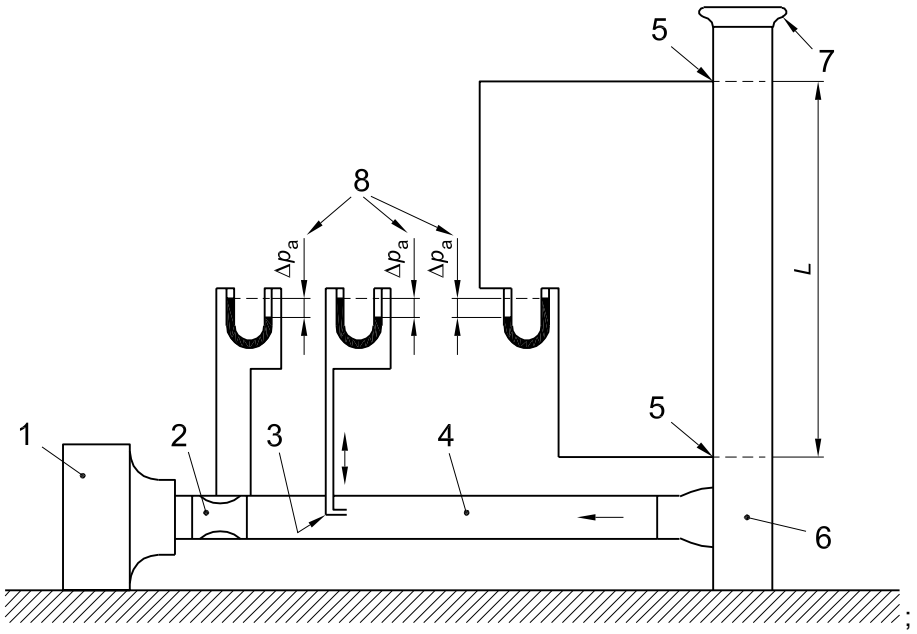
— date of manufacture or batch identification.

NOTE For CE marking refer to Annex ZA.

# Annex A
(normative)

# Measurement of the coefficient of friction of chimneys

Measurement of the coefficient of jointed flue blocks shall be done using the measuring set up shown in Figure A.1.




**Key**

1 Fan
2 Measuring device
3 Measuring device
4 Test tube
5 Static pressure manometer
6 Test chimney
7 Intake guide
8 Pressure manometer

**Figure A.1 — Roughness measuring rig**

*Measuring Procedure:*

Air is drawn in by a fan through the test length into a measuring pipe fixed at its end. The static pressure loss over a stated length is measured with an accuracy of 1 Pa. The air velocity in the test length can be measured by a measuring nozzle in terms of volume with an accuracy of + 2,5 %.

The friction coefficient is calculated following the equation:

$$\psi = \frac{2 \times D_h \times \Delta p}{\rho \times w \times L} \qquad \text{(A.1)}$$

where

$\psi$ is the coefficient of friction;

$D_h$ is the hydraulic diameter in m;

$\Delta p$ is the pressure loss in Pa;

$\rho$ is the density of air in kg/m$^3$;

$w$ is the velocity of air in m/s.

The mean roughness of the inner wall can be obtained by using the following equation:

$$\frac{1}{\sqrt{\psi}} = -2 \log \left( \frac{2.51}{\mathrm{Re}\sqrt{\psi}} + \frac{\tau}{3.71 D_h} \right) \quad \text{(A.2)}$$

where

$D_h$ is the hydraulic diameter in m;

$\tau$ is the mean value of roughness of the inner wall in m;

$Re$ is the Reynolds number;

$\Psi$ is the coefficient of friction of the flue.

For Reynolds numbers below 2 300, take the coefficient appropriate to the Reynolds coefficient equal of 2 300.

# Annex B
(normative)

# Thermal resistance

## B.1 Method 1: simplified calculation for flue blocks without cavities

The thermal resistance shall be determined approximately in accordance with the following equations if specific material properties and layer thicknesses are known:

a) With knowledge of the thermal resistances of the individual pipe shells

$$R = D_h \cdot \sum_n \left[ R_n \cdot \frac{1}{D_{h,n}} \right] \text{ in } m^2.K/W \qquad \text{(B.1)}$$

b) With knowledge of the coefficients of thermal conductivity of the layers

$$R = y \sum_n \frac{D_h}{2 \cdot \lambda_n} \cdot ln\left( \frac{D_{h,n+1}}{D_{h,n}} \right) \text{ in } m^2.K/W \qquad \text{(B.2)}$$

where

$R$ is the thermal resistance of a pipe shell, referring to its internal surface in $m^2.K/W$;

$y$ is the coefficient of form;

$y$ is equal to 1,0 for round and oval cross-sections;

$y$ is equal to 1,10 for square and rectangular cross-sections up to a ratio of sides equal to or less than 1,5;

$D_h$ is the internal hydraulic diameter in m;

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

$\lambda_n$ is the coefficient of thermal conductivity of the material of the layer at 200 °C in W/(m.K).

## B.2 Method 2: thermal resistance of flue blocks with or without cavities

### B.2.1 General

This Annex deals with the calculation of the thermal resistance of a chimney flue block made of one or several materials using a computer program.

This calculation is based on the transformation of the heat equation in a finite difference equation.

The "finite difference" form is developed for a network in the block where the dimensions are chosen according to each type of flue block. This network is in two co-ordinated directions (x,y).

## B.2.2 Data

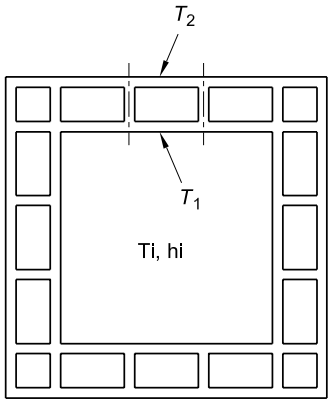
### B.2.2.1 Thermal properties of the material

Either use the thermal conductivity of the clay in two direction (x, y) given by the manufacturer or use the thermal conductivity given in Table B.1 depending on the clay density.

**Table B.1 — Thermal conductivity of the clay**

| Density<br>kg/m$^3$ | Thermal conductivity<br>W/(m.K) |
|---|---|
| 1 000 | 0,27 |
| 1 100 | 0,30 |
| 1 200 | 0,33 |
| 1 300 | 0,36 |
| 1 400 | 0,40 |
| 1 500 | 0,43 |
| 1 600 | 0,47 |
| 1 700 | 0,51 |
| 1 800 | 0,55 |
| 1 900 | 0,60 |
| 2 000 | 0,64 |
| 2 100 | 0,69 |
| 2 200 | 0,74 |
| 2 300 | 0,79 |
| 2 400 | 0,84 |

### B.2.2.2 Boundary conditions




**Key**

$T_i$ Internal temperature, i.e. flue gas temperature

$h_i$ Internal heat transfer coefficient

$T_1$, $T_2$ Internal surface temperature of the cavity

**Figure B.1 — Boundary conditions**

— Internal conditions:

$T_i$ = 200 °C

$h_i$ = 16,67 W/(m$^2$.K)

— External conditions:

$T_e$ = 50 °C

$h_e$ = 9,09 W/(m$^2$·K)

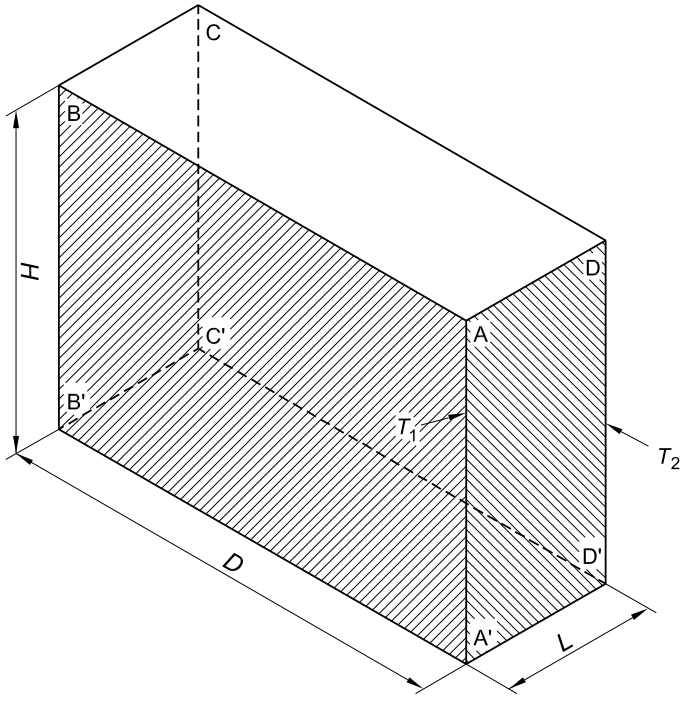
## B.2.3 Specific conditions for the cavities

### B.2.3.1 General

The cavities are considered like materials with thermal equivalent characteristics. It is considered that the heat flux transmitted by convection-conduction and the heat flux transmitted by radiation are reduced to a conduction problem.

The thermal equivalent conductivity of the cavity is calculated by a specific computer program unconnected with the program of the thermal resistance of the flue block.

The following notation scheme is used for the cavity:




**Key**

$L$ Width of the cavity in m

$H$ Height of the flue block in m

$D$ Length of the cavity in m

**Figure B.2 — Notation scheme used for the cavity**

The views ABB'A' and DCC'D' are respectively at the temperatures $T_1$ and $T_2$.

The views ADD'A' and BCC'B' are supposed adiabatic.

#### B.2.3.2 Heat transmitted by conduction-convection in the air

$$\Phi_c = h_c.(H.D).(T_1-T_2) \text{ in W} \quad \text{(B.3)}$$

where

$h_c$ is the convection coefficient in W/(m$^2$.K);

$h_c = \lambda_{air}/L$ in conduction only for the air at 170 °C, $\lambda_{air}$ = 0,0366 W/(m.K);

$\lambda_{air}$ is the air thermal conductivity in W/(m.K).

The transition between conduction and convection occurs at the following value of $Gr$ : (Grashof number):

$Gr = 4007 \,.\, A^{4/9}$

for $Gr > 4007 \,.\, A^{4/9}$, we will take:

$$h_c = \frac{4{,}6 \cdot 10^{-3} \cdot Gr^{1/4}}{L \cdot A^{1/9}} \quad \text{(B.4)}$$

for $Gr < 4007 \,.\, A^{4/9}$, we will take $h_c = 0{,}0366/L$

with $A = H/L$ and

$$Gr = \frac{\rho^2 \cdot g \cdot \beta}{\mu^2} \cdot L^3 \cdot (T_1 - T_2) \quad \text{(B.5)}$$

where

$\mu$ is the air dynamic viscosity (kg. m$^{-1}$.s$^{-1}$);

$\rho$ is the air density kg.m$^{-3}$ ;

$$\beta = \frac{1}{T}; \quad \text{(B.6)}$$

$\beta$ is the coefficient of thermal volumetric expansion in K$^{-1}$;

$g$ = 9,81 m.s$^{-2}$;

$g$ is the acceleration due to gravity in m.s$^{-2}$;

For the air at 170 °C

$$Gr = 2{,}34 \times 10^7 . L^3 (T_1-T_2) \quad \text{(B.7)}$$

### B.2.3.3 Heat transmitted by radiation

$\Phi_r = h_r .(H.D).(T_1-T_2)$ in W (B.8)

where

$h_r$ is the radiation coefficient in W/(m$^2$·K);

$\Phi_r$ is the thermal flow transmitted by radiation in W.

$$h_r = \frac{4 \cdot \sigma \cdot T_m^3}{2 \cdot \left[ 1/\varepsilon - \frac{F_{12}}{1+F_{12}} \right]} \quad \text{(B.9)}$$

where

$T_m = (T_1+T_2)/2$

$T_m$ is the mean temperature in K;

$\sigma$ is the Stefan-Boltzmann constant;

$\varepsilon$ is the clay emissivity equal to 0,9;

$F_{12}$ is the form factor of the face 1 towards face 2.

$X = H/L$

$Y = D/L$

$$F_{12} = \frac{2}{\pi \cdot X \cdot Y} \left\{ \ln \left[ \frac{(1+X^2)(1+Y^2)}{1+X^2+Y^2} \right]^{1/2} + X\sqrt{1+Y^2}\tan^{-1}\frac{X}{\sqrt{1+Y^2}} + Y\sqrt{1+X^2}\tan^{-1}\frac{Y}{\sqrt{1+X^2}} - X\tan^{-1}X - Y\tan^{-1}Y \right\} \quad \text{(B.10)}$$

### B.2.3.4 Equivalent thermal conductivity

h = hc + hr (B.11)

where

$h$ is the overall thermal transfer coefficient in W/(m$^2$.K)

$\lambda_e = h .L$

where

$\lambda_e$ is the equivalent thermal conductivity of the cavity in W/(m.K)

The equivalent thermal conductivity of a non rectangular cavity is determined to be that of a rectangular cavity having the same area and dimension ratio, in accordance with EN ISO 6946.

### B.2.4 Calculations

#### B.2.4.1 General

The calculation is made on a cross section perpendicular to the flue gas flow.

#### B.2.4.2 Numerical resolution

The result of the 2D numerical calculation is the heat flux (Φ) in Watt per meter of the height flue block

$$U_{\mathrm{i}} = \frac{\Phi}{(T_{\mathrm{i}} - T_{\mathrm{e}}) \cdot p_{\mathrm{i}}} \qquad \text{(B.12)}$$

where

$U_{\mathrm{i}}$ is the internal thermal transmission coefficient in W/(m$^2$.K);

$p_{\mathrm{i}}$ is the internal perimeter of the flue block in m.

$$R_{\mathrm{i}} = \frac{1}{U_{\mathrm{i}}} - \frac{1}{h_{\mathrm{i}}} - \frac{1}{h_{\mathrm{e}}} \cdot \left( \frac{p_{\mathrm{i}}}{p_{\mathrm{e}}} \right) \qquad \text{(B.13)}$$

$R_{\mathrm{i}}$ is the internal thermal resistance of the flue block in m$^2$.K/W;

$p_{\mathrm{e}}$ is the external perimeter of the flue block in m.

## B.3 Method Approximate thermal resistance values

Table B2 gives the approximate thermal resistance values for clay/ceramic flue blocks.

**Table B.2 — Thermal resistance of clay/ceramic flue blocks**

| Perforations | Overall wall thickness mm | Insulation | R (m$^2$.K)/W |
|---|---|---|---|
| Without | up to 50 | without | 0,05 |
| With 1 row | up to 30 | without | 0,08 |
| With 1 row | from 30 to 60 | without | 0,12 |
| With 2 rows | from 60 | without | 0,2 |
| With 1 row | from 30 to 60 | added | 0,46 |
| With 2 rows | from 60 | integrated | 0,55 |

# Annex C
(normative)

# Sampling procedures for an AQL of 10 % and Inspection Level S2

## C.1 Acceptability determination

### C.1.1 General

Single or double sampling may be used.

### C.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 normal inspection reinstated.

### C.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.

## C.2 Normal inspection

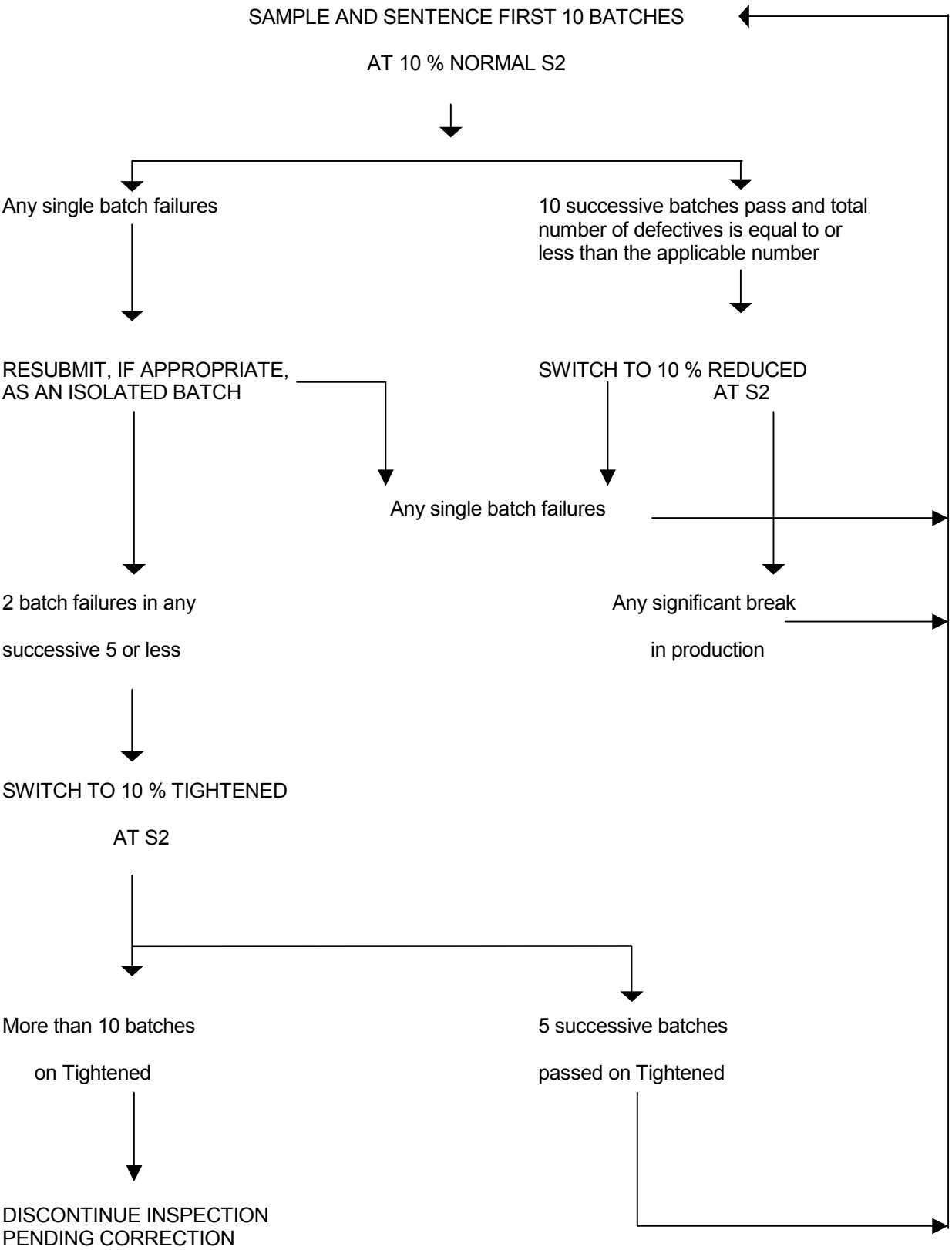
The sample size appropriate to the batch size and the acceptance and rejection values for numbers of defectives shall be in accordance with Table C.1. Sample units shall be selected at random.

**Table C.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 size | 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 |

SAMPLING PROCEDURES

Summary of sampling procedures (continuous batches)



## C.3 Normal to reduced inspection

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

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

b) the total number of defectives in the samples from the ten preceding batches (or such other number required by Table A3) is equal to or less than the limit number given in Table C.3.

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

**Table C.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 size | 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 C.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 79 | 2 |
| 80 to 129 | 4 |

## C.4 Reduced to normal inspection

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

## C.5 Tightened inspection

Tightened inspection as shown in Table C4 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 C.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 size | Accept number | Reject number |
| 8 to 20 000 | 8 | 1 | 2 | 5 | 0 | 2 | 5 | 1 | 2 |

## C.6 Tightened to normal inspection

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

## C.7 Discontinuation of inspection

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

# Annex ZA
(informative)

# Clauses of this European Standard addressing the provisions of EU Construction Products Directives

## ZA.1 Scope and relevant characteristics

This European Standard has been prepared under the mandate M/105 “Chimneys”, as amended, 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 M/105 “Chimneys”, as amended, given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the flue blocks and fittings covered by this European standard for their intended use indicated herein; reference shall be made to the information accompanying the CE marking.

**WARNING — Other requirements and other EU Directives, not affecting the fitness for intended use, can be applicable to the clay/ceramic flue blocks falling within the scope of this European Standard.**

NOTE 1 [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 (accessed through http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm).

This Annex establishes the conditions for the CE marking of the clay/ceramic flue blocks intended for the uses indicated in Table ZA.1.1 and Table ZA.1.2 and shows the relevant clauses applicable.

This Annex has the same scope as Clause 1 of this standard and is defined by Table ZA.1.1 and Table ZA.1.2.

**Table ZA.1.1 — Relevant clauses for flue blocks with or without inspection openings to be used as part of a multi wall chimney which convey products of combustion to the atmosphere**

| Construction product : Flue block with or without inspection openings covered in Clause 1 of this standard<br>Intended use : Part of a multi wall chimney which conveys products of combustion to the atmosphere | | | |
|---|---|---|---|
| **Essential characteristic** | **Requirement clauses in this standard** | **Levels and/or classes** | **Notes** |
| Resistance to fire internal to external | 8 Gas tightness and thermal shock resistance | G | |
| Gas tightness/leakage | 8 Gas tightness and thermal shock resistance | None | Declared pressure class |
| Flow resistance | 13 Flow resistance | None | Declared mean roughness in meter |
| Thermal resistance | 14 Thermal resistance | None | Declared value |
| Thermal shock resistance | 8 Gas tightness and thermal shock resistance | None | Declared temperature class |
| Durability against chemicals/corrosion | 9 Condensate resistance | None | Declared condensate class |
| Durability against chemicals | 10 Corrosion resistance | None | Declared corrosion resistance class |
| Compressive strength | 7 Proof load | None | Pass/fail criteria |
| Durability : resistance to freeze/thaw | 16 Freeze/thaw resistance | None | Pass/fail criteria |

**Table ZA.1.2 — Relevant clauses for flue blocks with or without inspection openings to be used as complete chimney which convey products of combustion to the atmosphere**

| Construction product : Flue block with or without inspection openings covered in Clause 1 of this standard<br>Intended use : complete chimney which conveys products of combustion to the atmosphere | | | |
|---|---|---|---|
| **Essential characteristic** | **Requirement clauses in this standard** | **Levels and/or classes** | **Notes** |
| Resistance to fire | 15.1.2 Soot fire test<br>8 Gas tightness and thermal shock resistance | Gxx | The declared distance xx is expressed in mm |
| Resistance to fire external to external | 15 External to external | | Declared value |
| Gas tightness/leakage | 8 Gas tightness and thermal shock resistance | None | Declared pressure class |
| Flow resistance | 13 Flow resistance | None | Declared mean roughness in meter |
| Thermal resistance | 14 Thermal resistance | None | Declared value |
| Thermal shock resistance | 8 Gas tightness and thermal shock resistance | None | Declared temperature class |
| Durability against chemicals/corrosion | 9 Condensate resistance | None | Declared condensate class |
| Durability against chemicals | 10 Corrosion resistance | None | Declared corrosion resistance class |
| Compressive strength | 7 Proof load | None | Pass/fail criteria |
| Durability : resistance to freeze/thaw | 16 Freeze/thaw resistance | None | Pass/fail criteria |

The requirement of 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 Clause 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 clay/ceramic flue blocks

### ZA.2.1 System of attestation of conformity

The system of attestation of conformity for clay/ceramic flue blocks of chimneys indicated in Table ZA.1.1 and Table ZA.1.2, in accordance with the decision of the Commission 95/467/EC as amended by the commission decision 01/596/EC, as given in Annex III of the mandate M/105 'Chimneys', is shown in Table ZA.2 for the indicated intended use and relevant level or class.

**Table ZA.2 — System of attestation of conformity**

| Product | Intended use | Level or class (Reaction to fire) | Attestation of conformity system |
|---|---|---|---|
| Flue blocks | Chimneys | Any | 2+ |
| System 2+: See Directive 89/106/EEC (CPD) Annex III.2.(ii), First possibility, including certification of the factory production control by an approved body on the basis of initial inspection of factory and of factory production control as well as of continuous surveillance, assessment and approval of factory production control. | | | |

The attestation of conformity of the products in Table ZA.1.1 and Table ZA.1.2 shall be according to the evaluation of conformity procedure indicated in Table ZA.3 resulting from application of the clauses of this or other European Standard indicated therein.

**Table ZA.3 — Assignment of evaluation of conformity tasks for flue blocks as part of a multi-wall chimney or flue blocks forming a complete chimney**

| Tasks | | | Content of the task | Clauses to apply |
|---|---|---|---|---|
| Tasks under the manufacturer | Factory production control (F.P.C) | | Parameters related to all characteristics of Table ZA.1.1 or Table ZA.1.2 | 17.4 |
| | Initial type testing | | All characteristics of Table ZA.1.1 or Table ZA.1.2 | 17.2 |
| | Further testing of samples taken at the factory | | All relevant characteristics of Table ZA.1.1 or Table ZA.1.2 | 17.3 |
| | Certification of FPC by the FPC certification body on the basis of | Initial inspection of factory and of F.P.C | Parameters related to all characteristics of Table ZA.1.1 or Table ZA.1.2 | 17.4 |
| | | Continuous surveillance, assessment and approval of F.P.C | Parameters related to all characteristics of Table ZA.1.1 or Table ZA.1.2 | 17.3<br>17.4 |

### ZA.2.2 EC certificate and declaration of conformity

When compliance with 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 shall draw up and retain a declaration of conformity, which entitles the manufacturer to affix the CE marking.

This declaration shall include:

— name and address of the manufacturer, or his authorised 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.

— 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.

— provisions to which the product conforms (i.e. Annex ZA of this EN) and a reference to the ITT report(s) and factory production control records (if appropriate);

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

— number of the accompanying factory production control certificate, and FPC records, where applicable;

— name and address of the notified laboratory(ies) [if some characteristics are tested by such a lab];

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

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

— name and address of the notified body;

— number of the factory production control certificate;

— conditions of validity of the certificate, where applicable;

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

The above mentioned declaration and certificate shall be presented in the language or languages accepted in the Member State in which the product is to be used.

## ZA.3 CE Marking and labelling

The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with Directive 93/68/EC and shall be shown on the flue block (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents, e.g. a delivery note). The following information shall accompany the CE marking symbol:

— identification number of the certification body;

— name or identifying mark and registered address of the manufacturer;

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

— number of the EC Certificate of Conformity or Factory Production Control Certificate (if relevant);

— reference to this European standard;

— description of the product: generic name, material, dimensions and intended use;

— information on those relevant essential characteristics listed in Table ZA.1.1 and Table ZA.1.2 which are to be declared presented as:

— declared values and, where relevant, level or class (including "pass" for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in “Notes” in Table ZA.1.1 and Table ZA.1.2;

— “No performance determined” for characteristics where this is relevant;

— as an alternative, a standard designation (as define Clause 19 of this standard) which shows some or all of the relevant characteristics (where the designation covers only some characteristics, it will be need to be supplemented with declared values for other characteristics as above.

The “No performance determined” (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.

Figures ZA.1.1 and ZA.1.2 give examples of the information to be given on the product, packaging and/or commercial documents.

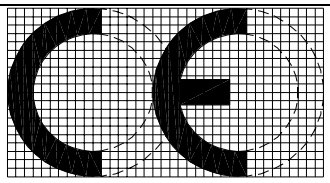
| | |
|---|---|
|  | *CE conformity marking consisting of the 'CE' symbol given in directive 93/68/EC* |
| AnyCo Ltd, P.O. Box 21, B – 1050<br><br>06<br><br>01234-CPD-00234 | *Name or identifying mark and registered address of the producer*<br><br>*Last two digits of the year in which the marking was affixed*<br><br>*Certificate number* |
| EN 1806 | *No. of European standard* |
| Clay/ceramic flue blocks which are part of a multi-wall chimney<br><br>T600-N1-D-3-G<br><br>Compressive strength…….Pass<br><br>Flow resistance……0,0015 m<br><br>Thermal resistance…….0,12 ($m^2$.K)/W<br><br>Thermal shock resistance YES<br><br>Durability : Freeze/thaw… NPD | *Description of product*<br><br>*and*<br><br>*information on regulated characteristics* |

**Figure ZA.1.1 — Example of CE marking information in the accompanying documents**

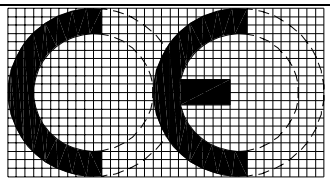
| | |
|---|---|
|  | *CE conformity marking consisting of the 'CE' symbol given in directive 93/68/EC* |
| AnyCo Ltd, P.O. Box 21, B – 1050 | *Name or identifying mark and registered address of the producer* |
| 06 | *Last two digits of the year in which the marking was affixed* |
| 01234-CPD-00234 | *Certificate number* |
| EN 1806 | *No. of European standard* |
| Clay/ceramic flue blocks which form a complete chimney<br><br>T600-N1-D-3-G100<br><br>Resistance to fire external to external…..NPD<br><br>Compressive strength…….Pass<br><br>Flow resistance……0,0015 m<br><br>Thermal resistance…….0,12 ($m^2$.K)/W<br><br>Thermal shock resistance YES<br><br>Durability : Freeze/thaw… NPD | *Description of product*<br><br>*and*<br><br>*information on regulated characteristics* |

**Figure ZA.2.2 — Example of CE marking information in the accompanying documents**

In addition to any specific information relating to dangerous substances shown above, the product 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 45012, *General requirements for bodies operating assessment and certification/registration of quality systems (ISO/IEC Guide 62:1996)*

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

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