BRITISH STANDARD

BS EN
1094-1:2008

Insulating refractory products

Part 1: Terminology, classification and methods of test for high temperature insulation wool products

ICS 81.080

BSI
British Standards

National foreword

This British Standard is the UK implementation of EN 1094-1:2008. It supersedes BS EN 1094-1:1997 and BS EN 1094-3:2003 and DD ENV 1094-7:1994 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee RPI/1, Refractory products and materials.

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

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2009

ISBN 978 0 580 54773 7

Amendments/corrigenda issued since publication

Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1094-1

July 2008

ICS 81.080

Supersedes EN 1094-1:1997, EN 1094-3:2003, ENV 1094-7:1993

English Version

Insulating refractory products - Part 1: Terminology, classification and methods of test for high temperature insulation wool products

Produits réfractaires isolants - Partie 1 : Terminologie, classification et méthodes d'essai pour produits à base de laine isolante à haute température

Feuerfeste Erzeugnisse für Wärmedämmzwecke - Teil 1: Terminologie, Klassifizierung und Prüfverfahren für Erzeugnisse aus Hochtemperaturwolle zur Wärmedämmung

This European Standard was approved by CEN on 25 May 2008.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1094-1:2008: E

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Foreword

This document (EN 1094-1:2008) has been prepared by Technical Committee CEN/TC 187 “Refractory products and materials”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by January 2009, and conflicting national standards shall be withdrawn at the latest by January 2009.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1094-1:1997, EN 1094-3:2003 and ENV 1094-7:1993.

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

1 Scope

This European Standard defines terms for those refractory products and materials which are classed as high temperature insulation wools (HTIW). It also establishes the classification of insulating refractory products made from HTIW and specifies methods for determining the thickness, bulk density, resilience, permanent linear change, tensile strength and moisture and organic matter content of HTIW products.

It applies to HTIW bulk wool, blankets, felts, mats, boards, pre-formed shapes and papers, with the exception of products delivered in a wet state.

Further test procedures are in development and will be included once they have been ratified. These include a 3 point bend test for boards, a length weighted fibre diameter measurement technique by Scanning Electron Microscope, shot content measurement (dry and wet methods) and thermal conductivity measurement. There is a shot content method described in ISO 10635 and there is a thermal conductivity technique described in ASTM C201.

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 1094 (all parts), *Insulating refractory products*

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)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 General terms and definitions

3.1.1
high temperature insulation wool
HTIW
man-made mineral wool suitable for use as heat-insulating materials above a temperature of 600°C and divided into amorphous alkaline earth silicate wools (AES), aluminosilicate wools (ASW) and the polycrystalline wools (PCW) with a classification temperature greater than 1 000 °C

3.1.2
wool
non-directional agglomeration of fibres with varying diameter and length distributions

3.1.3
fibre
particles with a length to diameter proportion of L/D > 3:1

3.1.4
AES-wool
amorphous wools with a typical composition range as given in Table 1

Table 1 — Typical Composition range of AES-wool

Component	Percentage by mass
CaO + MgO	18 to 43
SiO_2	50 to 82
$Al_2O_3 + TiO_2 + ZrO_2$	< 6
Other oxides	< 1

3.1.5
aluminosilicate wool
ASW
amorphous wools, subdivided into:

a) aluminosilicate wool ($Al_2O_3 + SiO_2$) with a composition range as given in Table 2; and

b) alumino zirconium silicate wool ($Al_2O_3 + ZrO_2 + SiO_2$) with a composition range as given in Table 3

Table 2 — Typical Composition range of aluminosilicate wool

Component	Percentage by mass
Al_2O_3	46 to 56
SiO_2	44 to 54
Other oxides	< 1

Table 3 — Typical Composition range of alumino zirconium silicate wool

Component	Percentage by mass
Al_2O_3	< 37
SiO_2	> 48
ZrO_2	< 20
Other oxides	< 1

3.1.6
polycrystalline wool
PCW
wool with a typical composition range as given in Table 4

Table 4 — Typical Composition range of polycrystalline wool

Component	Percentage by mass
Al_2O_3	72 to 97
SiO_2	3 to 28
Other oxides	< 0,1

3.1.7
resilience
ability of HTIW products to spring back after being compressed to 50 % of their initial thickness

3.1.8
tensile strength
apparent maximum tensile stress that the material can withstand

NOTE It is expressed in Pascals (Pa). It is given together with the bulk density determined by subclause 7.2

3.2 Materials and products made from high temperature insulation wool (HTIW)

3.2.1
bulk wool
wool in the state as produced before conversion into other products

NOTE 1 Bulk wool is available as:

a) wool with long fibres with or without finish (lubricant);

b) wool with chopped fibres with variable length due to their application.

NOTE 2 Lubricant is added to the fibres to keep them flexible for further processing the wool products. Typically, the wool products are thermally treated after production to remove the lubricant.

3.2.2
mat
flexible, non-needled wool without further bonding agent

3.2.3
blanket
flexible, needled mat, free of binders, with nominally determined dimensions

NOTE The mat is processed with barbed felt needles. In consequence, the product becomes denser and stronger.

3.2.4
felt
flexible, non-needled product with further bonding agents

3.2.5
module
blanket formed into thick sections by needling, stacking or folding sheets, compressed to a higher density and typically supplied with integral anchoring systems

NOTE Typically, the bulk density of modules is between 160 kg/m^3 and 300 kg/m^3. Modules can be of a complex shape.

3.2.6
paper
flexible insulating material formed on a paper-making machine

NOTE Typically, thin shaped HTIW products are kept together by an organic binder (e.g. latex).

3.2.7
board
rigid flat sheet, usually containing inorganic and/or organic binders, produced by a wet process fired or unfired

3.2.8
pre-formed product and shapes
rigid shape with the addition of inorganic and/or organic binders, fired or unfired

NOTE Depending on their production process pre-formed products are subdivided into:

a) vacuum shaped products;

b) mixed products wherein different types of HTIW but also refractory fillers are put together;

c) plastic shaped products;

d) laminated pre-formed products wherein boards, paper or felts are stuck together (on top of each other or rolled);

e) die-cut products made of blankets, boards or paper.

3.2.9
yarn
bulk HTIW twisted into a continuous thread, with or without the addition of reinforcing filaments

3.2.10
rope
yarn twisted to a rope, with or without reinforcing

NOTE Ropes can be reinforced by glass or metal fibres.

3.2.11
cloth
yarn woven to cloth

3.2.12
mouldable/castable/mastic product
product used for moulding, casting or repairs.

NOTE Mouldable products of HTIW are, for example, added in different proportions to unshaped refractory products as defined in EN 1402-1.

4 Classification temperature

The product is classified according to the temperature at which the shrinkage obtained by the permanent linear change in dimensions test, as described in subclause 7.4, does not exceed a given value.

According to the nature of the product, the shrinkage value shall not exceed:

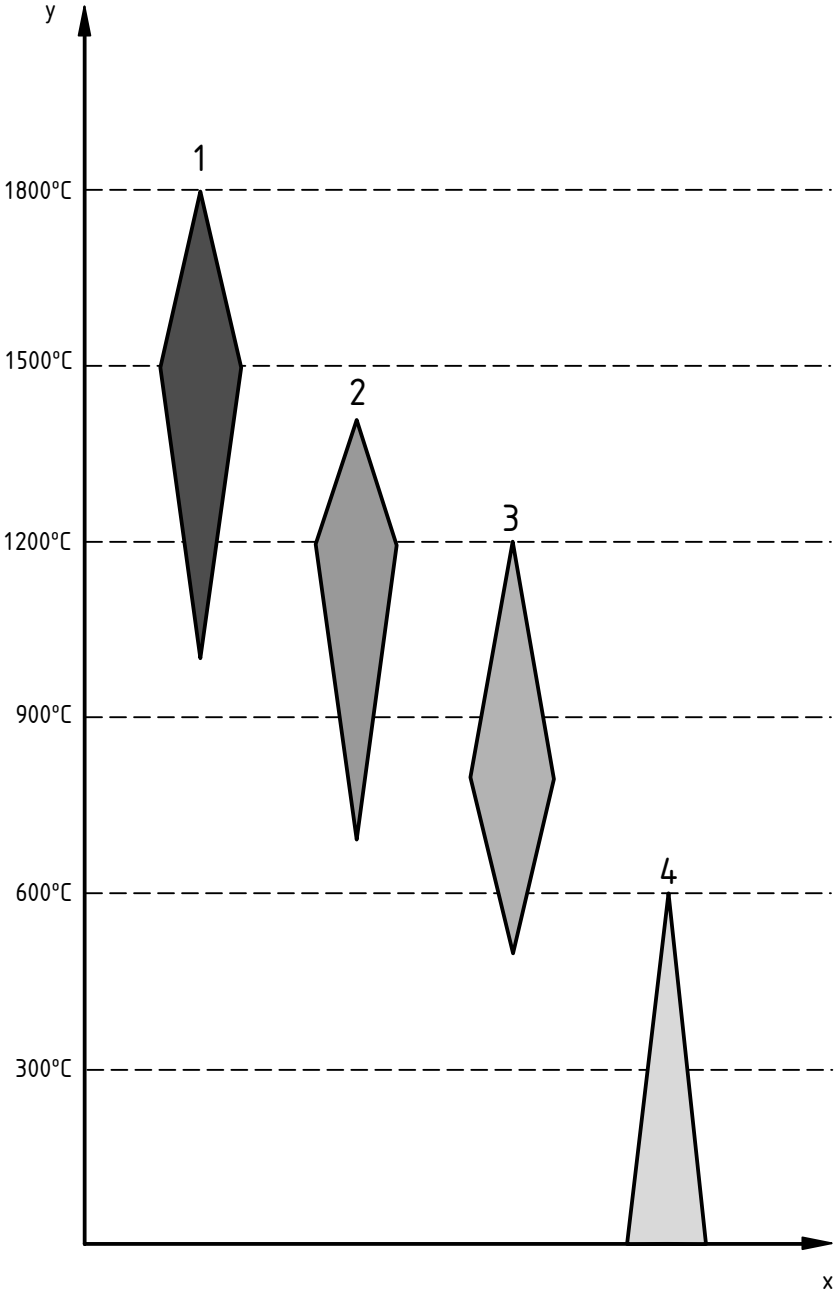
— 2 % for boards and preformed shapes;

— 4 % for blankets, felts, mats and papers.

The temperature shall be reported to the nearest 50°C, starting at 850°C and going up to 1 800°C in 50°C increments.

NOTE Classification temperature does not imply that the product can be used continuously at this temperature. In practice maximum continuous use temperature for amorphous HTIWs will typically be approximately 100°C to 150°C lower than the classification temperature. Polycrystalline wool can usually be used up to its classification temperature. The atmosphere, application (e.g. single use vs. extended) and contact with other substances should all be considered carefully when selecting the type of high temperature insulation wool for a particular application.

Typical application temperatures are shown in Figure 1.



Key
X Type of wool
Y Temperature °C
1 Polycrystalline wool
2 Alumino-Silicate and Alumino-Zirconium-Silicate Wool
3 Alkaline-Earth-Silicate Wool (AES)
4 Mineral wools (Glass and Rock wool)

NOTE The width of the polygon shows the proportion of a wool type used in the corresponding temperature range.

Figure 1 —Typical application temperatures of HTIW

5 Number of test pieces

The number of items to be tested shall be determined by agreement between the parties. The number of test pieces per item shall be determined in accordance with Table 5.

6 Preparation of test pieces

When the material to be tested is in a roll form, any compressed material at the extreme ends shall be excluded. A strip shall be cut perpendicular to the length across the full material width, of sufficient size for the different tests planned.

From the strip, cut the required number of test pieces of required dimensions, using a template, a sharp knife, a saw, or other method which will not damage the sample. Avoid excess pressure as this may crush the product.

Table 5 — Summary of test methods and designations, applicability to product types and number of test pieces per item required

Clause	Test	Material	Number of test pieces
6.1	Measured thickness: 725 Pa method or 350 Pa method	Blanket, Felt, Mat, Board	3
	For HTIW 50 kPa method, excluding AES where 10 kPa method is used.	Paper	3
6.2	Bulk density	Blanket, Felt, Mat, Board, Paper	3
6.3	Resilience	Blanket, Felt, Mat	3
6.4	Permanent linear change on heating	Blanket, Felt, Mat, Board, Paper	3
6.6	Tensile strength	Blanket, Felt, Paper	5
6.6	Moisture and organic content	Bulk wool, Blanket, Felt, Mat, Board, Paper	3

7 Test methods

7.1 Determination of the measured thickness

7.1.1 General

Because of packing, transport and storage, flexible HTIW products often show differences between measured and nominal thickness as given by the manufacturer.

7.1.2 Principle

Determination of the measured thickness of a product subjected to a compressive stress which depends on its nominal bulk density.

There are two methods, of which the dial gauge comparator method (7.1.4) is the reference method and is the only method applicable to HTIW paper.

7.1.3 Test piece dimensions

The size of the test piece shall be such that the disc entirely rests on it, and shall be at least (100 x 100) mm.

7.1.4 Dial gauge comparator method

7.1.4.1 Apparatus

7.1.4.1.1 Dial gauge comparator and its base, configured with a 75 mm metallic disc capable of applying a (350 ± 7) Pa compressive stress to products with a nominal bulk density less than 96 kg/m^3 and a (725 ± 15) Pa compressive stress to products with a nominal bulk density equal to or higher than 96 kg/m^3.

7.1.4.2 Procedure

For HTIW papers, except AES paper, carry out the measurement under a compressive stress of (50 ± 1) kPa.

For AES paper a compressive stress of (10 ± 1) kPa shall be used with a disc of 12,5 mm diameter.

Put the test piece on a hard, flat surface and let the disc rest on the product, care being taken not to induce additional pressure. Measure the thickness at the disc centre with respect to the hard, flat surface to the nearest ± 0,1 mm.

7.1.5 Needle method

7.1.5.1 Apparatus

7.1.5.1.1 Measuring device, made up of a needle (150 ± 1) mm in length and 3 mm in diameter, and a metallic disc 75 mm in diameter, with a central hole 3, 5 mm to 4 mm diameter, which slides along the needle and is capable of being secured in position.

Note Two metallic discs of different mass are required, one having a mass sufficient to exert a stress of 350 Pa, the other having a mass sufficient to exert a stress of 725 Pa.

7.1.5.1.2 Vernier calliper.

7.1.5.2 Procedure

The stress determined by the mass of the disc and of its securing device shall not exceed (350 ± 7) Pa for products with a nominal bulk density less than 96 kg/m3 and (725 ± 15) Pa for products with a nominal bulk density equal to or higher than 96 kg/m3.

Put the product to be measured on a hard, flat surface, punch it with the needle and remove the needle. For the measurement, bring back the needle point in contact with the hard, flat surface and lower the disc on to the surface of the product, care being taken not to induce additional pressure. Secure the disc in position, remove the whole device and measure the distance between the needle point and the disc to the nearest 0,1 mm.

7.1.6 Test report

Prepare a test report in accordance with Clause 8, including the dimensions of each test piece, the individual values for each test piece and the mean value for each item.

7.2 Determination of the measured bulk density

7.2.1 General

It is normal practice for the manufacturer to supply a product stating the nominal bulk density where the nominal thickness is used in place of measured thickness. The calculation uses the method described below to measure the mass and dimensions of the sample.

NOTE "Nominal" refers to the values supplied by the manufacturer and are aimed for specifications only.

7.2.2 Principle

After determining thickness accordance with clause 7.1, bulk density is determined by calculation of the ratio between the mass of the product and its geometrically determined volume.

7.2.3 Apparatus

7.2.3.1 **Thickness measurement device**, as in 7.1.4.1. or 7.1.5.1.

7.2.3.2 **Steel rule**, reading to 0,5 mm, possibly with a square angle at the readings origin, or alternatively, callipers.

7.2.3.3 **Ventilated oven** capable of maintaining a temperature of (110 ± 5) °C.

7.2.3.4 **Balance**, of 2 kg capacity, capable of measuring to the nearest ± 0,1 g.

7.2.4 Test pieces

The dimensions of the test pieces shall be in accordance with 7.1.3.

Dry the test pieces at (110 ± 5) °C to constant mass. Constant mass can be considered as achieved when the mass variation between two weighings carried out within a one hour interval does not exceed 0,1%.

Reject any test piece where the loss of mass exceeds 5 % after drying.

7.2.5 Procedure

Measure the length and breadth of the test piece along the middle of each face with the steel rule or the callipers to the nearest 0,5 mm. Determine the thickness in accordance with subclause 7.1 and calculate the area of the test piece.

Weigh the test piece to the nearest 0,1 g.

7.2.6 Calculation and expression of results

Calculate the bulk volume V_b of the test piece, in m^3, using the equation:

$$V_b = S \cdot t$$

where

S is the area of the test piece in m^2;

t is the measured thickness of the test piece in m.

Calculate the bulk density, ρ, of the test piece, in kg/m^3, using the equation:

$$\rho = \frac{m}{V_b}$$

where

m is the dry mass in kg, determined in 7.2.5;

V_b is the bulk volume in m^3.

7.2.7 Test report

Prepare a test report in accordance with Clause 8, including the mass and dimensions of each test piece, reference to the method for thickness, and the individual values for each test piece and a mean for each item.

7.3 Determination of resilience

7.3.1 General

The determination of resilience is based on the results of the tests described in 7.1 and 7.2.

7.3.2 Principle

Calculation of the ratio, expressed in %, of the final thickness of a product to its initial thickness, after application of a compressive stress sufficient to reduce the initial thickness to 50 % for a given time.

The initial thickness is the measured thickness as measured in subclause 7.1. The final thickness is the thickness after relaxation as measured in subclause 7.1.

7.3.3 Apparatus

7.3.3.1 Compression testing machine, capable of applying the compressive stress at a given rate and provided with means for measuring the test piece deformation.

7.3.4 Test pieces

7.3.4.1 Dimensions

Cut out test pieces of dimensions (100 x 100) mm x (measured thickness). Minimise compression of the test pieces when cutting out.

7.3.4.2 Drying

Dry the test pieces in accordance with 7.2.4.

7.3.5 Procedure

Determine the measured thickness in accordance with subclause 7.1. Set the compression testing machine to give a constant deformation rate of 2 mm/min.

Place the test piece in the compression tester and compress at the given rate until the test piece thickness has been reduced by 50 % ± 1%.

NOTE 1 If a record of compressive stress versus measured thickness is required, record the compressive stress at regular % reductions of the original thickness.

Keep the test piece at 50 % of its initial thickness for 5 min and then remove the majority of the pressure applied by the testing machine but just maintaining a nominal pressure of either:

— 350 Pa for products with a bulk density (measured in accordance with 7.2) less than 96 kg/m^3, or

— 725 Pa for products with a bulk density (measured in accordance with 7.2) equal to or higher than 96 kg/m^3.

After 5 min, determine the thickness in accordance with subclause 7.1.

NOTE 2 Other values for reduction of the thickness may be chosen by agreement between the parties, using the same procedure.

7.3.6 Calculation and expression of results

Calculate resilience, R, in %, using the equation:

$$R = \left(\frac{t_t - t_c}{t_i - t_c} \right) \times 100$$

where

t_t is the thickness after testing;

t_c is the thickness when compressed;

t_i is the initial measured thickness.

Calculate the permanent deformation, D_p, in %, using the equation:

$$D_p = 100 \times \left(\frac{t_i - t_t}{t_i - t_c} \right)$$

7.3.7 Test report

Prepare a test report in accordance with Clause 8, including the dimensions of the test pieces and the thickness method, also any value for reduction of the thickness, if different from 50%, individual values of permanent deformation/resilience, and the mean values of permanent deformation/resilience.

7.4 Determination of the permanent linear change on heating

7.4.1 Principle

Determination of the permanent linear change of the dimensions of test pieces held at a prescribed temperature and for a prescribed time interval.

The permanent linear change is expressed as the ratio of the difference between the initial dimension and the dimension after testing measured between platinum wire markers inserted into the test piece surface on the initial dimension.

7.4.2 Apparatus

7.4.2.1 Electric furnace ,with a temperature distribution not exceeding 10°C between any two points in the furnace.

The dimensions of the furnace shall be such as to ensure that test pieces are at least 50 mm away from heating elements and that the test piece and the thermocouple junction are 10 mm to 20 mm apart.

7.4.2.2 Measuring devices

Measurements shall preferably be by means of an optical method using a travelling microscope oriented horizontally.

7.4.2.3 Thermocouples

A minimum of three thermocouples to measure the temperature and temperature distribution over the space occupied by the test pieces.

7.4.3 Test pieces

7.4.3.1 Dimensions

The dimensions of the test pieces shall be (100 x 100) mm x (measured thickness).

The direction of rolling of blanket shall be recorded.

7.4.3.2 Drying

Dry the test pieces in accordance with 7.2.4.

7.4.4 Procedure

7.4.4.1 Test-piece preparation

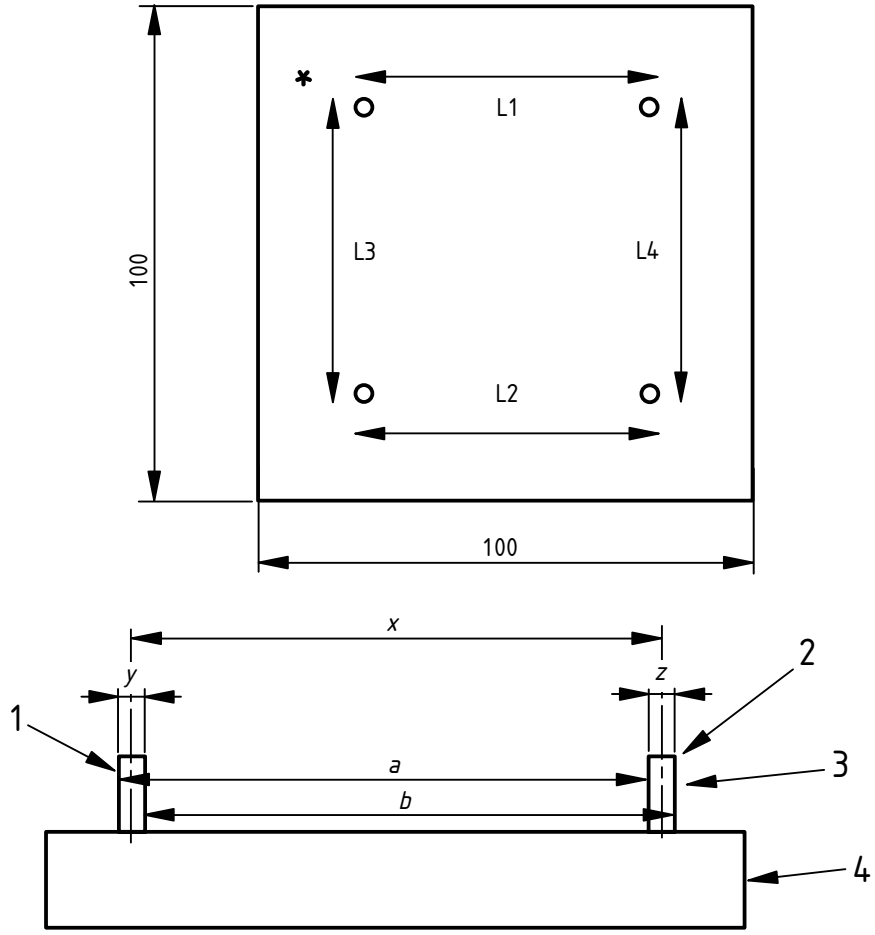
On the diagonals of the upper (100 x 100) mm surface of each test piece, and 10 mm to 15 mm away from the edges, insert four platinum wire markers so that they are approximately 75 mm apart. Add a reference pin in the corner between the lengths L1 and L3 to maintain the samples' orientation after firing.

These markers shall be 0,5 mm in diameter, their length being such as to leave up to 5 mm protruding above the surface when they are inserted at a depth corresponding to at least 3/4 of the test piece thickness.

The centre to centre distance between each pair of platinum wire markers is measured. This is achieved by measuring the distance between the left hand side of both wire markers and the right hand side of both wire markers, where the markers enter the sample. These two distances are totalled and the value divided by two. This gives the centre to centre value. It is usual practice to place a platinum wire marker in one of the corners of the sample as a reference marker for the orientation of the sample after firing.

The positioning of the markers and the method of measurement are shown in Figure 2.

Dimensions in millimetres



Key
* reference pin
O Pt pin
1. pin thickness y
2. pin thickness z
3. Pt pin
4. test piece

Figure 2 — Position of the markers and method of measurement

The measurement required is pin centre to centre distance x. By carrying out the measurements shown in Figure 2:

a) $a + z = x + \frac{y}{2} + \frac{z}{2}$

rearranging gives:

$$a = x + \frac{y}{2} - \frac{z}{2}$$

b) $b + y = x + \frac{y}{2} + \frac{z}{2}$

rearranging gives:

$$b = x - \frac{y}{2} + \frac{z}{2}$$

Combining these equations gives:

$$a + b = 2x$$

i.e. $$x = \frac{(a+b)}{2}$$

Thus by measuring the distances a (left to left hand side of pins) and b (right to right hand side of pins) and dividing by 2, the centre to centre distance of the pins can be measured.

Take the measurements to the nearest 0,05 mm. The means of measurement shall be reported in the test report.

7.4.4.2 Heating

Place the test pieces on a 100 mm x 100 mm plinth cut from the same material, each plinth being used for one test only. For easier handling, place the plinth on a flat refractory support (see note below) 10 mm to 15 mm in thickness.

Place test pieces in the furnace so that:

a) they are at least 25 mm apart from each other;

b) they are at least 50 mm away from the heating elements.

NOTE AES wools strongly react in contact with some other oxides (i.e. Al_2O_3).

Raise the temperature in the furnace at one of the heating rates given in Table 6.

Hold the test temperature to within ± 10 °C for 24 h. At the end of this period, cool the test pieces by at least 200 °C within 30 min.

Table 6 — Heating rates

For test temperatures up to 1250 ˚C	
from ambient temperature up to 50 ˚C below the test temperature	between 5 and 10 °C/min
for the last 50 ˚C	between 1 and 2 ˚C/min
For test temperatures > 1250 °C	
from ambient temperature up to 1200 ˚C	between 5 and 10 ˚C/min
from 1200 ˚C to 50 ˚C below the test temperature	between 2 and 5 ˚C/min
for the last 50 ˚C	between 1 and 2 ˚C/ min

7.4.4.3 Measurement of the test pieces after the test

Allow test pieces to cool in the furnace until it is practical to remove them without damage and then allow them to cool further to room temperature, then measure the distances between markers as previously.

7.4.5 Calculation and expression of the results

For each test piece, calculate the permanent linear change as the mean of two values measured in two different directions, expressed as a percentage of the initial length measured between the platinum wire markers.

Express the test result as the mean of the values recorded for each direction on each of the three test pieces.

7.4.6 Test report

Prepare a test report in accordance with clause 8, including the bulk density, the measuring device, the heating rate, with the test result in each direction and the mean for each test piece.

7.5 Determination of the tensile strength

7.5.1 Principle

A test piece of prescribed dimensions is cut from the product or the item, and the tensile strength determined by causing rupture of the test piece at room temperature.

7.5.2 Apparatus

7.5.2.1 Tensile testing machine, provided with two pairs of jaws allowing the clamping of the test piece over a 75 mm x 40 mm area.

This device shall be capable of straining the test piece in tension at a constant cross head speed and shall be Class 2 as defined by EN ISO 7500-1.

7.5.3 Test pieces

Cut at least five test pieces (230 ± 5) mm x (75 ± 2) mm x (measured thickness). As far as possible, take test pieces at random along the longitudinal axis of the product. It is preferable that the longest dimension of the test piece (230 mm) is parallel with the manufacturing direction of the product.

NOTE By agreement between parties, and for supplementary tests, test pieces can be taken perpendicular to the manufacturing direction.

Dry test pieces at (110 ± 5) °C, then cool them to room temperature in a desiccator and carry out testing immediately on removal.

7.5.4 Procedure

Measure the thickness of the test piece in the area to be strained in accordance with subclause 7.1, using the dial gauge comparator method and the width using a ruler accurate to ± 1 mm.

Clamp the test piece at both ends so that a surface area of approximately (75 x 40) mm is held in the jaws of the testing machine.

The rate of the tensile stress shall be variable so that the piece deformation occurs at a constant speed of 100 mm/min during the whole test. Apply the stress parallel with the manufacturing direction of the product.

In the calculation, reject values from tests where parting occurred closer to the jaws than to the centre. In this case, cut new test pieces

For the calculation of the results, use the maximum load recorded in the course of a test resulting in the parting of the test piece.

7.5.5 Calculation and expression of the results

Calculate the tensile strength, $R(m)$, in Pa, using the equation

$$R(m) = \frac{F}{W \cdot t}$$

where

F is the maximum parting force, in N;

W is the width of the active part of the test piece, in m;

t is the measured thickness of the test piece, in m, as measured in subclause 7.1.

Express the test result as the mean of those determinations together with the bulk density of the product determined in accordance with subclause 7.2.

7.5.6 Test report

Prepare a test report in accordance with Clause 8, including the direction of taking out test pieces, the type of tensile testing machine, the bulk density of the product, and the mean of five determinations carried out on five test pieces.

7.6 Determination of moisture and organic matter content

7.6.1 General

Because of its relatively high surface area, HTIWs are susceptible to moisture pick-up after manufacture and especially during storage. Often it is necessary to know if the product has adsorbed water.

Additionally organic binders are used in many of the articles manufactured with HTIWs and it is often necessary to measure the content of these binders.

7.6.2 Principle

Moisture and organic contents are measured by weight loss of the sample at temperatures suitable to remove the water or organic material.

7.6.3 Apparatus

7.6.3.1 **Balance**, capable of weighing to the nearest 0,001 g.

7.6.3.2 **Silica dish**, or other suitable container.

7.6.3.3 **Ventilated oven**, capable of maintaining (110 ± 5) °C.

7.6.3.4 **Desiccator**.

7.6.3.5 **Muffle furnace**, capable of heating test pieces to (650 ± 10) °C.

7.6.4 Procedure

7.6.4.1 Moisture content

Use three test pieces. Weigh not less than 10 g of the sample to ± 0,001 g, (M_1) and place in a tared dry dish. Dry in the ventilated oven for not less than 1 hour, cool in the desiccator and reweigh (M_2).

7.6.4.2 Organic content

Dry sample as described above to obtain dried weight (M_2). Heat the sample in a muffle furnace at (650 ± 10) °C for not less than 1 hour. Furnace should be at temperature and sample should be removed from furnace whilst still at 650°C. Initially cool, for example on a heat-resisting mat, and when sufficiently cool, transfer to a desiccator. When cool, reweigh (M_3).

7.6.5 Calculation and expression of result

Calculate the moisture content (M_m), expressed as a percentage of the original sample mass, using the equation:

$$M_m = \frac{M_1 - M_2}{M_1} x\,100$$

where

M_1 is the initial mass of the sample, in g;

M_2 is the mass of the sample after drying, in g.

Calculate the total organic matter content (M_o), expressed as a percentage of the dry sample mass, using the following equation:

$$M_o = \frac{M_2 - M_3}{M_2} x\,100$$

where

M_2 is the mass of the sample after drying, in g;

M_3 is the mass of the sample after heating, in g.

7.6.6 Test report

Prepare a test report in accordance with Clause 8, including the individual results and their mean.

8 Test report

The test reports shall contain the following:

a) all information necessary for identification of the sample tested;

b) reference to this European Standard (EN 1094:2008);

c) designation of the product tested, in accordance with EN 1094;

d) specific information given for each of the methods used;

e) results of the test(s), including results of the individual determinations and their mean(s), calculated as specified in Clause 6;

f) name of the testing establishment;

g) number of items tested;

h) the number of test pieces per item;

i) any deviations from the procedure(s) specified;

j) any unusual features (anomalies) observed during the test;

k) date of the test.

Bibliography

[1] ISO 565 *Test sieves - Metal wire cloth, perforated metal plate and electroformed sheet - Nominal sizes of openings*

[2] EN 1402-1, *Unshaped refractory products - Part 1: Introduction and classification*

[3] ISO 10635:1999, *Refractory Products. Methods of Test for Ceramic Fibre Products*

[4] ASTM C201, *Standard Test Method for Thermal Conductivity of Refractories*

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