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# Fire tests on building materials and structures —

## Part 11: Method for assessing the heat emission from building materials

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## Cooperating organizations

The Fire Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

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Association of Metropolitan Authorities	Fire Offices Committee*
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Eurisol (UK) Association of Manufacturers of Mineral Fibre Insulation	

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# Foreword

This Part of this standard, prepared under the direction of the Fire Standards Committee, is the first in a new series of methods for evaluating the different properties of building materials, components and structures under fire conditions, which are to be published within the BS 476 series. Part 10<sup>1)</sup> will form an introduction to this new series of methods.

This Part describes the equipment and procedure used for the assessment of heat emission from building materials. Engineering drawings for the apparatus, which is similar to that described in ISO 1182, will be published as PD 6508. In line with other new methods under preparation, this standard specifies the way in which test results are to be recorded but does not attempt to specify acceptance criteria, which depend upon the conditions of use of the material tested.

Fire is a complex phenomenon: its behaviour and its effects depend upon a number of interrelated factors. The behaviour of materials or combinations of materials in a fire depends upon the characteristics of the fire, the method of use of the materials and the environment in which they are exposed. A method such as is described in this standard deals only with a simple representation of a particular aspect of the potential fire situation typified by a defined heat source, and it cannot alone provide any direct guidance on behaviour or safety in fire. This test is not intended to assess the effect of materials on fire growth and for this purpose other fire tests in the BS 476 series are more appropriate, but a test of this type may be used for comparative purposes or to ensure the existence of a designated level of performance considered to have a bearing on fire performance generally. It would be wrong to attach any other meaning to performance in this test.

Attention is drawn to the Health and Safety at Work etc. Act 1974, and the need to ensure that the method described in this standard is carried out under suitable environmental conditions to provide adequate protection to personnel against the risk of fire, inhalation of smoke and/or toxic products of combustion.

**CAUTION.** The mechanical sawing and drilling of asbestos cement components attracts the provision of the Asbestos Regulations 1969. Adequate methods exist to control levels of dust during such operations and these are detailed in the Control and Safety Guides issued by the Asbestos Research Council<sup>2)</sup>.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

## Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 16, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

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<sup>1)</sup> In course of preparation.

<sup>2)</sup> Available from the Asbestos Information Centre, Sackville House, Piccadilly, London W1.

## 1 Scope

This Part of this British Standard describes a method for assessing the heat emission from building materials when inserted into a furnace at a temperature of 750 °C.

This method is applicable to simple materials or mixtures of materials, either manufactured or naturally occurring, that are reasonably homogeneous and from which it is possible to obtain specimens representative of the material as a whole. It is also applicable to non-homogeneous materials providing that irregularities within the material, such as density gradient, particle size, and/or voids, are not disproportionately large compared with the size of the specimen.

This method is not normally suitable for assessing combinations of materials, such as those that are surface coated, veneered or faced or that contain discrete layers of materials that have been fixed or glued together as laminates. However, providing that sufficiently representative specimens can be produced, the individual discrete materials may be assessed separately [see clause 8 f)].

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

## 2 Specimen construction and preparation

**2.1 Number and size of specimens.** Five specimens shall be prepared, each shall be representative of the material to be assessed, and shall not normally be specifically cast or moulded to size.

The specimens shall be cylindrical and each shall have a diameter of  $45 + 0, - 2$  mm and a height of  $50 \pm 2$  mm.

### 2.2 Preparation of specimens

**2.2.1** If the thickness of the material to be assessed (see 2.1 and A.1) is not  $50 \pm 2$  mm, the specimen shall be prepared as follows:

- a) for a material with a thickness greater than 52 mm, it shall be reduced to give a specimen of height specified in 2.1;

- b) if the thickness of the material is less than 48 mm, specimens of the height specified in 2.1 shall be made by using a sufficient number of layers of the material and/or by adjustment of the material thickness; the layers shall occupy a horizontal position in the specimen holder and shall be held together firmly, without significant compression, by means of two fine steel wires of nominal diameter 0.5 mm (see A.1).

**2.2.2** A 2 mm diameter hole of sufficient length to locate the hot junction of the specimen thermocouple at the geometric centre of the specimen shall be made axially down from the top of the specimen (see A.1.3).

**2.3 Conditioning of specimens.** Before testing, the specimens shall be conditioned to constant mass<sup>3)</sup> at a temperature of  $23 \pm 2$  °C and a relative humidity of  $50 \pm 10$  %. Each specimen shall be retained in the conditioning atmosphere until immediately prior to testing.

## 3 Apparatus

### 3.1 General

**3.1.1** The apparatus shall consist essentially of a furnace comprising a refractory tube surrounded by a heating coil and enclosed in an insulating surround. A cone-shaped airflow stabilizer shall be attached to the base of the furnace and a draught shield to its top. A typical arrangement for the apparatus is shown in Figure 1.

NOTE All dimensions given in the following description of the apparatus are nominal values unless tolerances are specified.

**3.1.2** The apparatus shall be mounted on a stand and be equipped with a specimen holder and a device for inserting the specimen holder into the furnace tube.

**3.1.3** The apparatus shall be provided with an electrical earth.

**3.1.4** Thermocouples shall be provided for measuring the furnace temperature, the furnace wall temperature and the temperature at the centre of the specimen.

### 3.2 Furnace, stand and draught shield

**3.2.1** The furnace tube shall be made of an alumina refractory material as specified in Table 1, of a density  $2800 \pm 300$  kg/m<sup>3</sup>, and shall be  $150 \pm 1$  mm high with an internal diameter of  $75 \pm 1$  mm and a wall thickness of  $10 \pm 1$  mm. The overall wall thickness, including the refractory cement applied to retain the electrical winding, shall not exceed 15 mm.

<sup>3)</sup> Constant mass is considered to be reached when the results of two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1 % of the mass of the specimens.

**Table 1 — Composition of the furnace tube refractory material**

Material	% by mass
Alumina (Al <sub>2</sub> O <sub>3</sub> )	> 89
Silica and alumina (SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> )	> 98
Iron (III) oxide (Fe <sub>2</sub> O <sub>3</sub> )	< 0.45
Titanium dioxide (TiO <sub>2</sub> )	< 0.25
Manganese oxide (Mn <sub>3</sub> O <sub>4</sub> )	< 0.1
Alkali oxides and trace compounds	the balance

**3.2.2** The furnace tube shall be provided with a single winding of 80/20 nickel/chromium resistance tape 3 mm wide and 0.2 mm thick, which shall be wound as shown in Figure 2. The ends of the resistance tape shall be terminated in a junction box. The top of the furnace tube shall be clearly indicated (see A.2.1 and A.2.2).

**3.2.3** The furnace tube shall be fitted in the centre of a surround made of asbestos cement sheet or similar material. The surround shall be 150 mm in height and have an internal diameter of 180 mm, a wall thickness of 10 mm, and shall be fitted with top and bottom plates recessed to locate the ends of the furnace tube. The annular space between the furnace tube and the surround shall be filled with magnesium oxide powder of bulk density  $140 \pm 20 \text{ kg/m}^3$ ; (see A.2.3).

**3.2.4** To the underside of the furnace shall be attached an open-ended cone-shaped airflow stabilizer 500 mm in length, reducing uniformly from an internal diameter of  $75 \pm 1 \text{ mm}$  at the top to an internal diameter of  $10 \pm 0.5 \text{ mm}$  at the bottom. The stabilizer shall be made from 1 mm thick sheet steel and shall be finished smooth on the inside. The joint between the stabilizer and the furnace tube shall be an airtight fit and shall be finished smooth on the inside. The upper half of the stabilizer shall be insulated externally with a 25 mm thick layer of mineral fibre insulating material having a thermal conductivity of  $0.04 \pm 0.01 \text{ W/(m K)}$  at a mean temperature of 20 °C.

**3.2.5** A draught shield shall be made of the same material as the stabilizer, shall be provided at the top of the furnace and shall be 50 mm high with an internal diameter of  $75 \pm 1 \text{ mm}$ . The draught shield and its joint with the top of the furnace shall be finished smooth on the inside, and the exterior shall be insulated with a 25 mm thick layer of mineral fibre insulation having a thermal conductivity of  $0.04 \pm 0.01 \text{ W/(m K)}$  at a mean temperature of 20 °C.

**3.2.6** The assembly of the furnace, stabilizer and draught shield shall be mounted on a firm stand provided with a base and draught screen attached to the stand to reduce draughts around the bottom of the stabilizer. The draught screen shall be approximately 550 mm high and the bottom of the stabilizer shall be approximately 250 mm above the baseplate.

### 3.3 Specimen holder and insertion device

**3.3.1** The specimen holder and its support shall be as shown in Figure 3. The specimen holder including its gauze base shall be made of nickel/chromium or a heat-resisting steel wire. The total mass of the specimen holder shall be  $15 \pm 2 \text{ g}$ .

**3.3.2** The specimen holder support shall be provided with a suitable insertion device for lowering the specimen holder precisely down the axis of the furnace tube, so that the geometric centre of the specimen is located rigidly at the geometric centre of the furnace during the test. The insertion device shall consist of a metal sliding rod moving freely within a vertical guide fitted to the side of the furnace (see Figure 1).

### 3.4 Thermocouples

**3.4.1** Mineral insulated stainless steel sheathed thermocouples shall be used, having an external diameter of 1.5 mm, with nickel chromium/nickel aluminium thermocouple elements of 0.3 mm nominal diameter. Each thermocouple hot junction shall be of the insulated type.

**3.4.2** The furnace thermocouple shall be located with its hot junction  $10 \pm 0.5 \text{ mm}$  from the furnace tube wall and at a height corresponding to the mid-point of the furnace tube. The position of the thermocouple may be set using the locating guide shown in Figure 4, and its correct position shall be maintained by means of a guide attached to the draught shield. A new furnace thermocouple shall be artificially aged before use in order to reduce its reflectivity (see A.3).

**3.4.3** The specimen thermocouple shall be positioned so that its hot junction is located at the geometric centre of the specimen. This shall be achieved by means of the 2 mm diameter hole in the top of the specimen (see 2.2.2 and Figure 5).

**3.4.4** The contact thermocouple shall be of the type described in 3.4.1 with its end bent to allow a horizontal contact with the interior of the furnace wall (as shown in Figure 6, detail B).

**3.4.5** The thermocouples shall be connected to the temperature indicator (see 4.2) using suitable compensating cables, care being taken to ensure that the thermocouple compensating cable junctions are protected from heat during the test.

## 4 Ancillary equipment

### 4.1 Electrical equipment

**4.1.1 General.** The electrical equipment shall consist of either a voltage stabilizer, variable transformer and electrical input monitor, or a power controller.

**4.1.2 Voltage stabilizer.** The voltage stabilizer shall be a single-phase automatic voltage stabilizer with a nominal rating of not less than 1.5 kV·A. It shall be capable of maintaining the accuracy of the output voltage within  $\pm 1\%$  of the rated value from zero to full load.

**4.1.3 Variable transformer.** The variable transformer shall be capable of accepting a maximum of 1.5 kV·A and of regulating the voltage output from zero to a maximum value equal to that of the input voltage. The voltage output shall vary linearly over its range.

**4.1.4 Electrical input monitor.** An ammeter, voltmeter or wattmeter shall be provided to enable rapid setting of the furnace to approximately the operating temperature. Any of these instruments shall be capable of measuring the levels of electrical power required by **5.3**.

**4.1.5 Power controller.** The power controller shall be of the type that incorporates phase angle firing and shall be linked to a thyristor unit capable of supplying 1.5 kV·A.

The voltage and current limits shall be adjusted to give "100 % power" equivalent to the maximum rating of the heater element. The stability of the power controller shall be approximately 1.0 % and the setpoint repeatability shall be  $\pm 1.0\%$ . The power output shall be linear over the setpoint range.

**4.2 Temperature indicator.** The temperature indicator shall be a zero current device capable of continuously measuring the output from the thermocouples to the nearest 1 °C or the millivolt equivalent. It shall be capable of assimilating the incoming data and producing a permanent record of this at intervals of not greater than 0.5 s. A suitable instrument is either a digital device or a multirange chart recorder with a back-off facility, which includes an operating range of 10 mV full scale deflection with a "zero" of approximately 700 °C.

**NOTE** Because the outputs of two thermocouples are recorded during the procedure, a two-channel instrument or two separate indicators are required.

**4.3 Timing device.** The timing device shall be capable of recording elapsed time to the nearest second and shall be accurate to within 1 s in 1 h.

**4.4 Balance.** The balance shall be readable and accurate to 0.1 g.

**4.5 Observation mirror.** To facilitate observation of sustained flaming and for the safety of the operators, a mirror shall be provided and positioned not less than 0.5 m above the draught shield on top of the furnace.

**NOTE** A mirror approximately 300 mm square, at an angle of 30° to the horizontal 1 m above the furnace, has been found to be suitable.

## 5 Setting up procedure

**5.1 Test environment.** The apparatus shall be sited so that it is not exposed to draughts, sunlight or to intense artificial illumination when in use.

### 5.2 Interconnection of apparatus and ancillary equipment

**5.2.1** With the specimen holder removed from the furnace, position the furnace thermocouple as specified in **3.4.2** and connect it to the temperature indicator using compensating cables as described in **3.4.5**.

**5.2.2** Connect the heating element of the furnace to either the voltage stabilizer, the variable transformer and the electrical input monitor, or the power controller (see **4.1**), as shown in Figure 7. Automatic thermostatic control of the furnace shall not be used during testing.

**5.3 Furnace stabilization.** With the specimen holder removed from the furnace, adjust the power input to the furnace so that the temperature, as indicated by the furnace thermocouple, is stabilized for at least 10 min at  $750 \pm 5$  °C, taking a continuous record of this temperature during this period (see **4.2**).

**NOTE** The heating element draws a current of between 9 A and 10 A at approximately 100 V under steady state conditions. In order not to overload the winding, it is recommended that the maximum current does not exceed 11 A. A new furnace tube should be subject to slow initial heating (see **A.2.2**).

### 5.4 Furnace calibration

**5.4.1 General.** The calibration procedure of **5.4.3** shall be carried out for any new furnace and whenever the furnace tube, its winding, or insulation, is replaced.

**5.4.2 Calibration requirement.** When calibrated by the procedure given in **5.4.3**, the average furnace wall temperature, as calculated in **5.4.3 d**), shall be  $835 \pm 10$  °C and shall be maintained in this range to the start of the test.



### 5.4.3 Calibration procedure

a) When the furnace temperature, as indicated by the furnace thermocouple, has stabilized as specified in 5.3, use the contact thermocouple (see 3.4.4) to determine the furnace wall temperature at nine points. These nine points comprise three points on each of three vertical axes spaced equally around the circumference of the furnace wall, the points being at a position mid-height of the furnace tube and at positions both 30 mm above and 30 mm below the mid-point height.

NOTE This procedure may conveniently be achieved by using a suitable thermocouple scanning device with the thermocouple and insulating tubes in the positions shown in Figure 6.

b) Pay particular attention to the contact between the contact thermocouple and the furnace wall which, if poor, will lead to low temperature readings.

c) At each measurement point ensure that the temperature recorded by the thermocouple is stable for at least 5 min before taking the temperature reading.

d) Calculate the arithmetic mean of the nine temperature readings made in a) and record this as the average furnace wall temperature.

b) in situations where the specimen temperature ( $T_c$ ) does not rise above the furnace temperature ( $T_f$ ), the specimen temperature ( $T_c$ ) has passed its maximum and its temperature gradient is negative and less than 5 °C over a period of 10 min;

c) when, in all other cases than those described in a) and b), a test time of 120 min has been completed.

NOTE Examples of final temperature equilibrium are illustrated in Figure 8, where, types 1 and 2 show typical conditions under a), type 3 shows typical conditions under b) and type 4 shows typical conditions under c).

**6.1.7** Record the maximum furnace temperature,  $T_{f,max}$  (in °C), the furnace temperature at the end of the test,  $T_{f,final}$  (in °C), the maximum specimen temperature,  $T_{c,max}$  (in °C) and the specimen temperature at the end of the test,  $T_{c,final}$  (in °C).

**6.1.8** After cooling to ambient temperature, recover any char or other debris that breaks off the specimen and falls down the tube either during or following the test and include as a part of the unconsumed specimen. Weigh the specimen and record its mass.

**6.1.9** When the test has been terminated according to conditions 6.1.6 a) or b), repeat the procedure in 6.1.2 to 6.1.8 for all the other four specimens. When the test has been terminated according to condition 6.1.6 c), only one further specimen shall be tested, provided that it confirms condition 6.1.6 c) and neither specimen gives sustained flaming (see 6.2.1). If the second specimen does not confirm condition 6.1.6 c) or either specimen gives sustained flaming, the remaining three specimens shall be tested as described in 6.1.2 to 6.1.8.

### 6.2 Observations during test

**6.2.1** The occurrence of sustained flaming shall be noted and the duration of such flaming during the test shall be recorded. Sustained flaming shall be taken as the continuous presence of flames lasting 5 s or longer (see A.5).

**6.2.2** Any other relevant observations and difficulties experienced during testing shall be noted.

## 7 Expression of results

**7.1 Temperature rises.** For each specimen, calculate the furnace temperature rise,  $T_F$ , and the specimen temperature rise,  $T_C$ , from the expressions

$$T_F = T_{f,max} - T_{f,final}$$

$$T_C = T_{c,max} - T_{c,final}$$

## 6 Test procedure

### 6.1 Procedure

**6.1.1** Stabilize the furnace as specified in 5.3 and record the mean temperature as the initial furnace temperature,  $T_{f,initial}$  (in °C).

**6.1.2** Weigh the specimen, prepared and conditioned as specified in clause 2; record its mass and actual dimensions, and insert it into the specimen holder. Insert the specimen thermocouple into the specimen as described in 3.4.3.

**6.1.3** Place the specimen holder into the furnace in the position specified in 3.3.2 taking not more than 5 s for this operation.

**6.1.4** Start the timing device immediately following the insertion of the specimen into the furnace.

**6.1.5** Record the temperatures measured by both the furnace thermocouple,  $T_f$  (in °C), and specimen thermocouple,  $T_c$  (in °C), throughout the test.

**6.1.6** Continue the test until final temperature equilibrium is established. This shall be when one of the following conditions apply:

a) the specimen temperature ( $T_c$ ) has dropped back below the furnace temperature ( $T_f$ ) and the temperature gradient on both  $T_c$  and  $T_f$  is negative and less than 5 °C over a period of 10 min.

Calculate and record the arithmetic mean for the specimens for both furnace ( $T_F$ ) and specimen ( $T_C$ ) temperature rises, and record the number of specimens tested (see 6.1.9).

**7.2 Flaming.** For each specimen note the sum of the recorded durations of sustained flaming as specified in 6.2.1.

Calculate the arithmetic mean of the sustained flaming of the five specimens and record as the "mean duration of sustained flaming".

**7.3 Density.** Calculate and record the density (in  $\text{kg/m}^3$ ) from actual dimensions and mass (see 6.1.2) for each individual specimen tested.

Calculate the arithmetic mean of the density (in  $\text{kg/m}^3$ ) of the specimens tested.

**7.4 Mass loss.** Calculate and record the mass loss of each individual specimen tested as a percentage (%) of the initial mass of the specimen (see 6.1.8).

Calculate the arithmetic mean of the mass loss of the specimens tested as a percentage (%).

## 8 Report

The report shall quote the individual results as required by clauses 6 and 7. Any observations made during the test and comments on any difficulties experienced during testing shall also be given, together with the following:

- a) name and address of testing laboratory;
- b) name and address of sponsor;
- c) name and address of manufacturer/supplier;
- d) date of test;

e) a general description of the material tested including trade name (or other identification), together with the form of construction of the specimen, including any preparation thereof, and the number of specimens tested (see 6.1.9);

f) when an individual discrete material that forms part of a combination of materials has been tested (see clause 1), a description of its relationship to the other materials in the combination, and if appropriate, reference to the separate reports on the other materials;

g) the statement: "The results relate only to the behaviour of the specimens of the material under the particular conditions of the test. The results obtained on an individual material used in a combination should not be construed as reflecting the performance of the material combination as a whole, which may be influenced by the mechanism of combining the individual materials together, such as with adhesives. The results are not intended to be the sole criterion for assessing the potential fire hazard of the material in use."

If required, a summary report shall contain the information given in Appendix B.



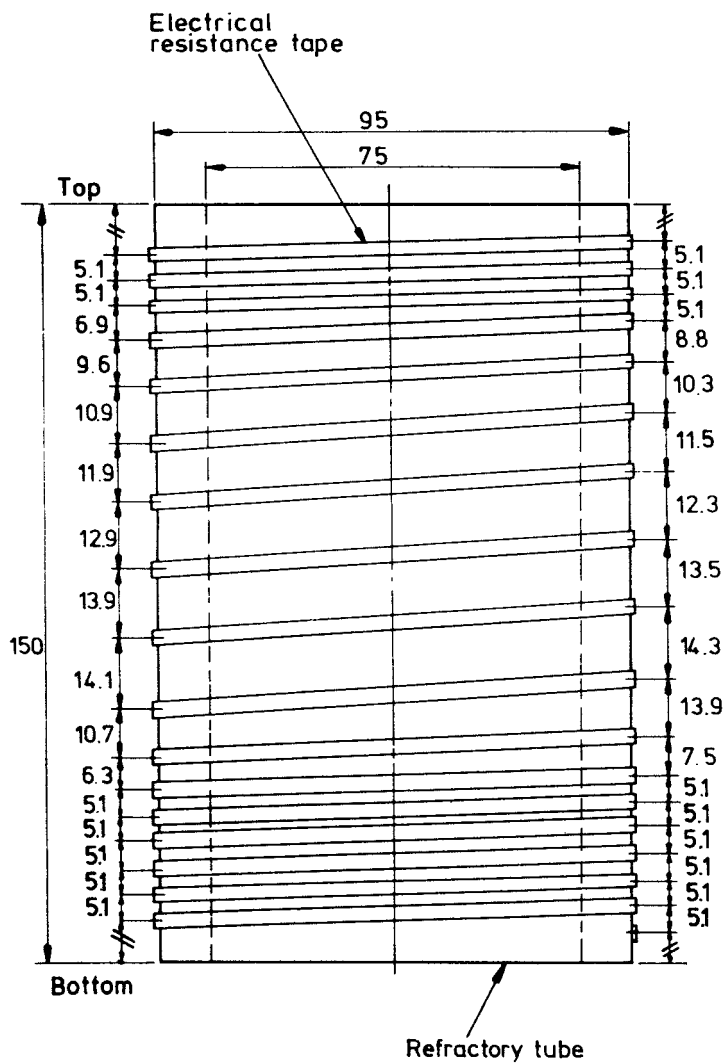
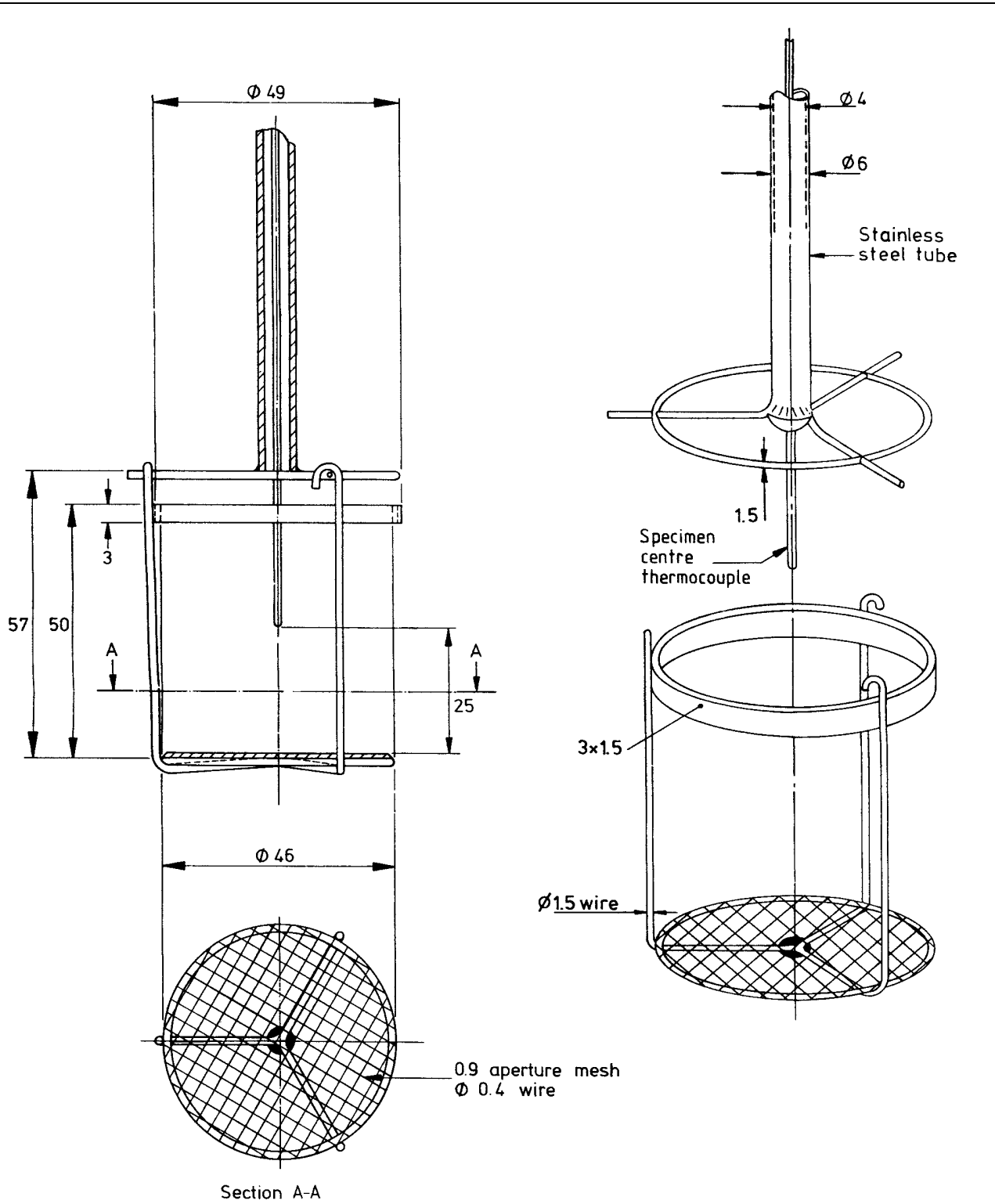
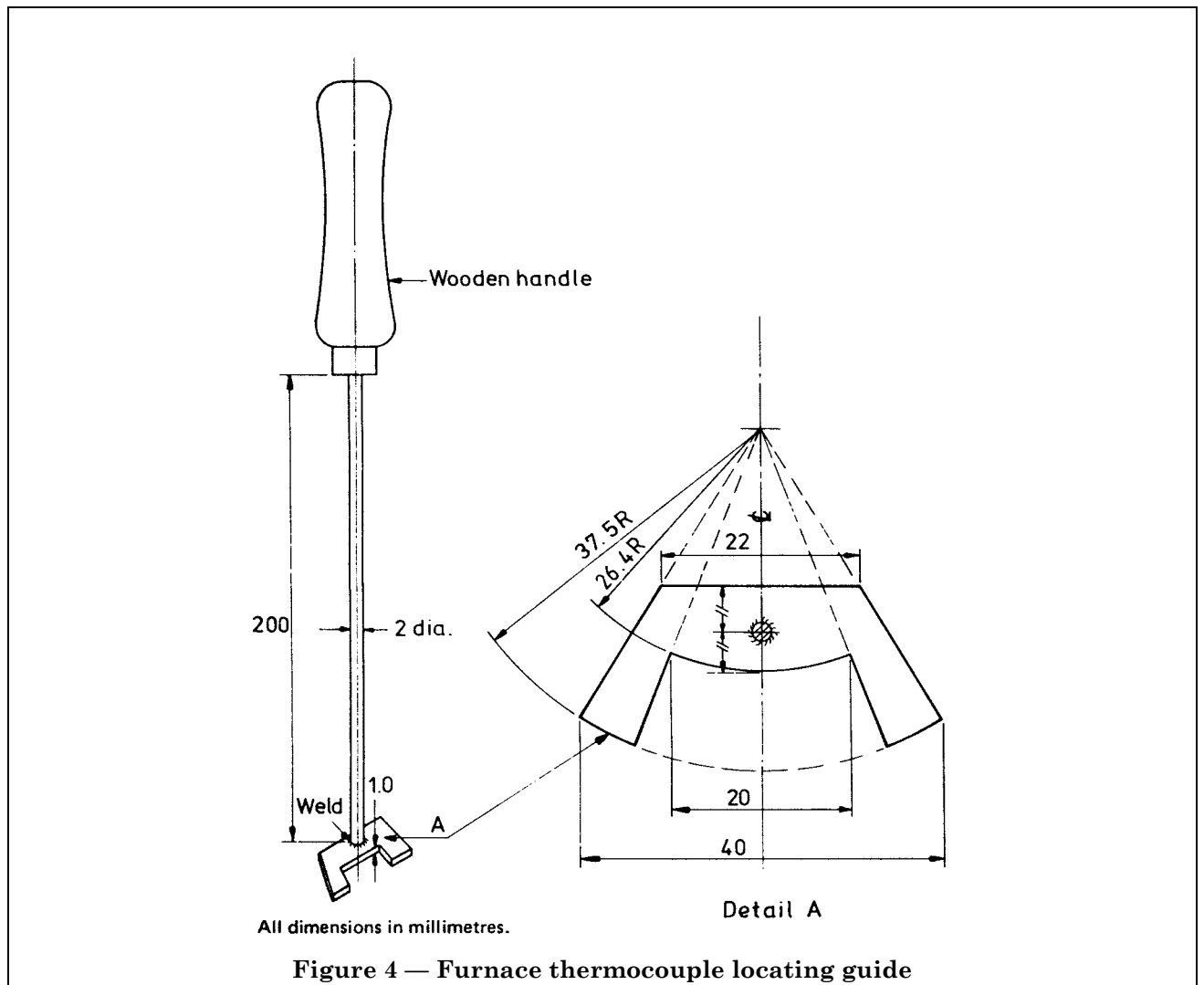


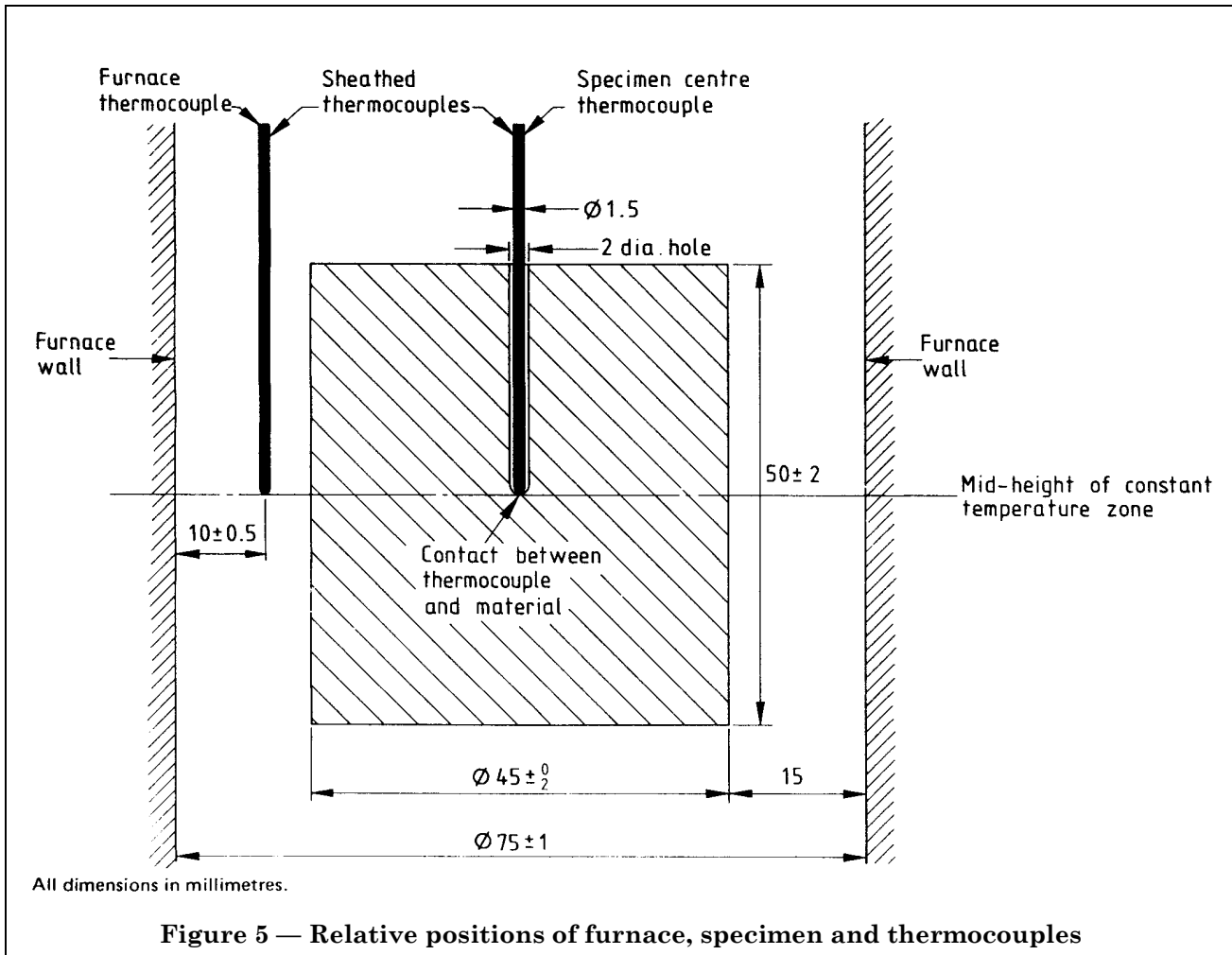
Figure 2 — Layout of furnace winding



All dimensions in millimetres.

Figure 3 — Specimen holder and support





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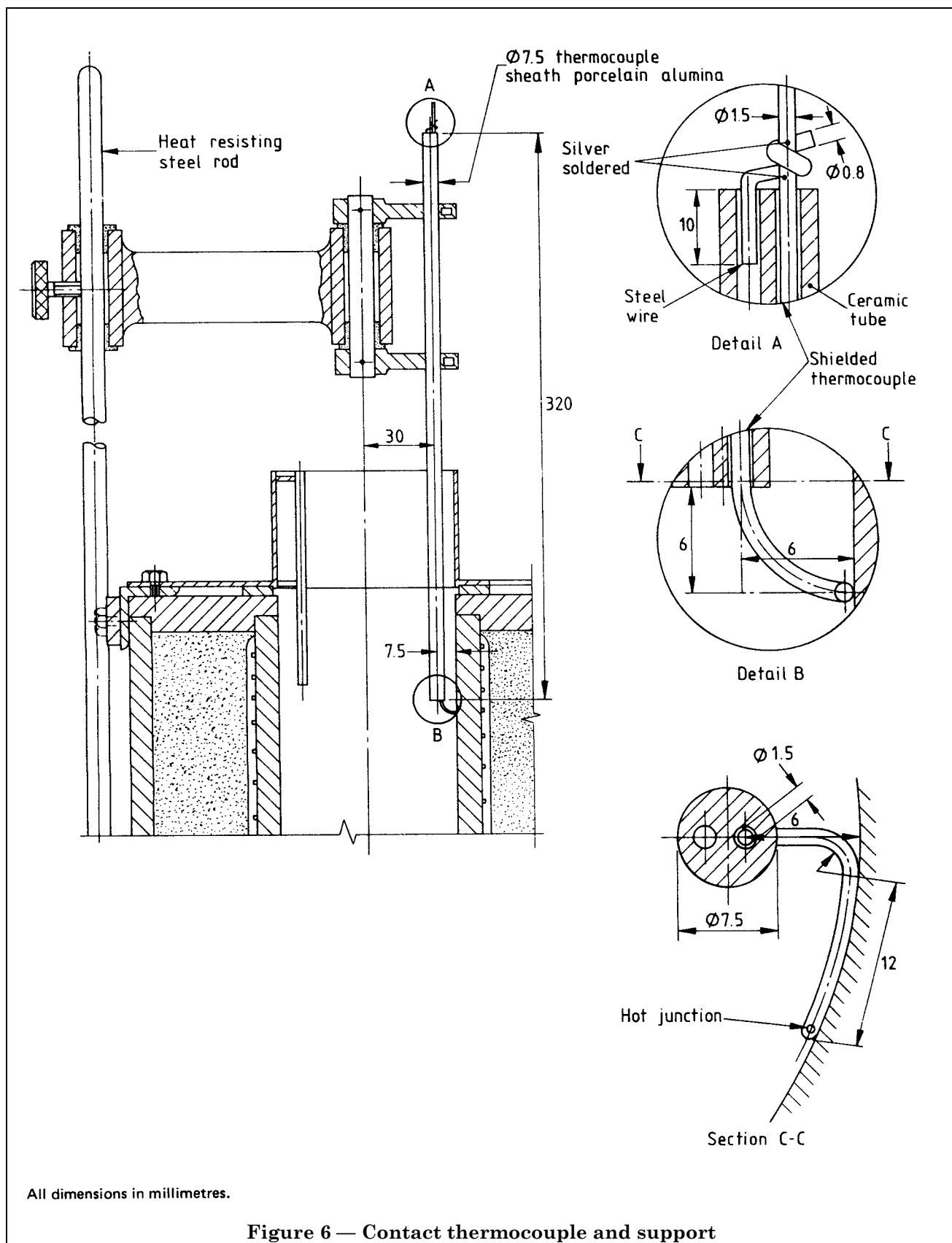


Figure 6 — Contact thermocouple and support



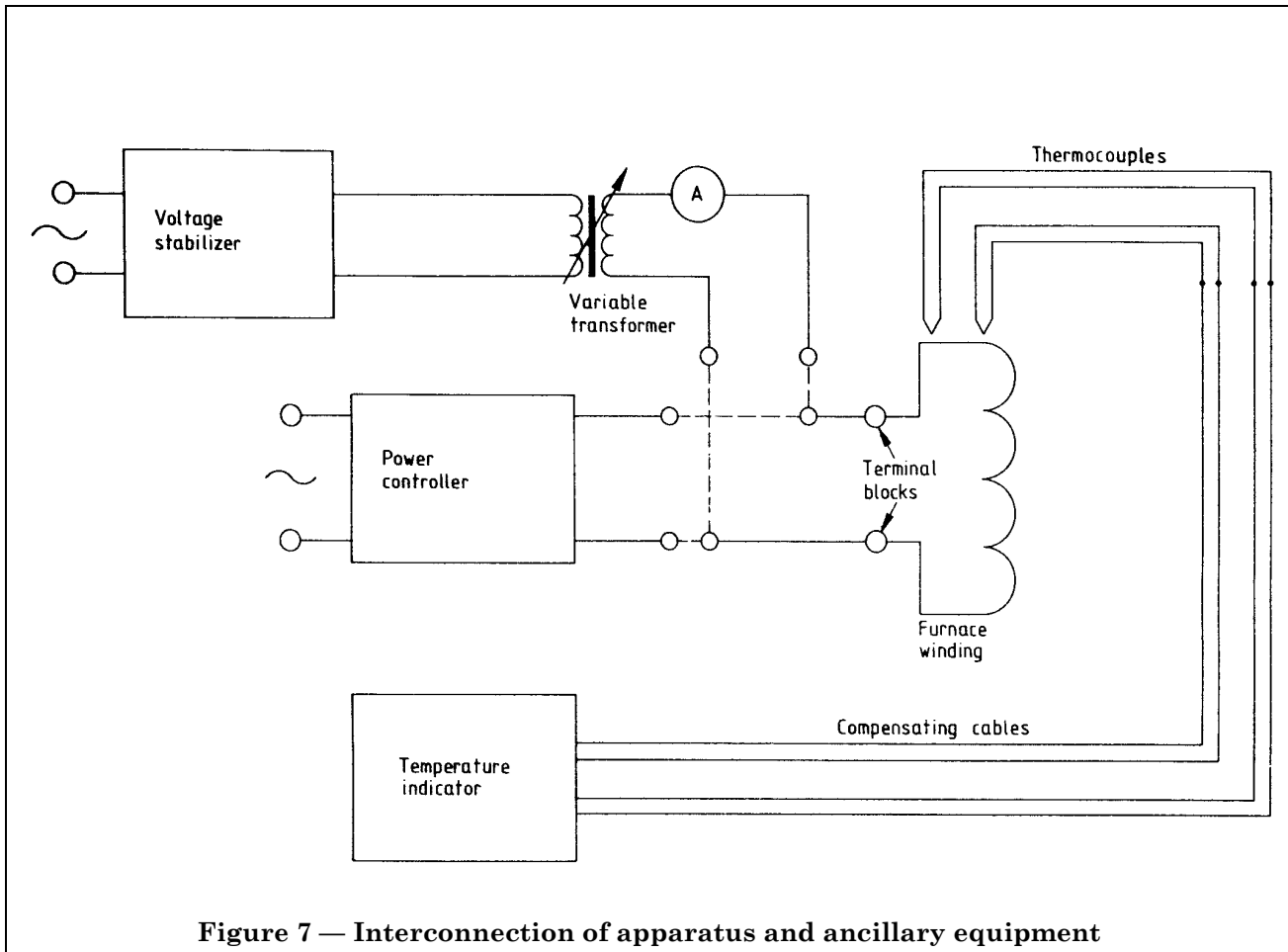


Figure 7 — Interconnection of apparatus and ancillary equipment

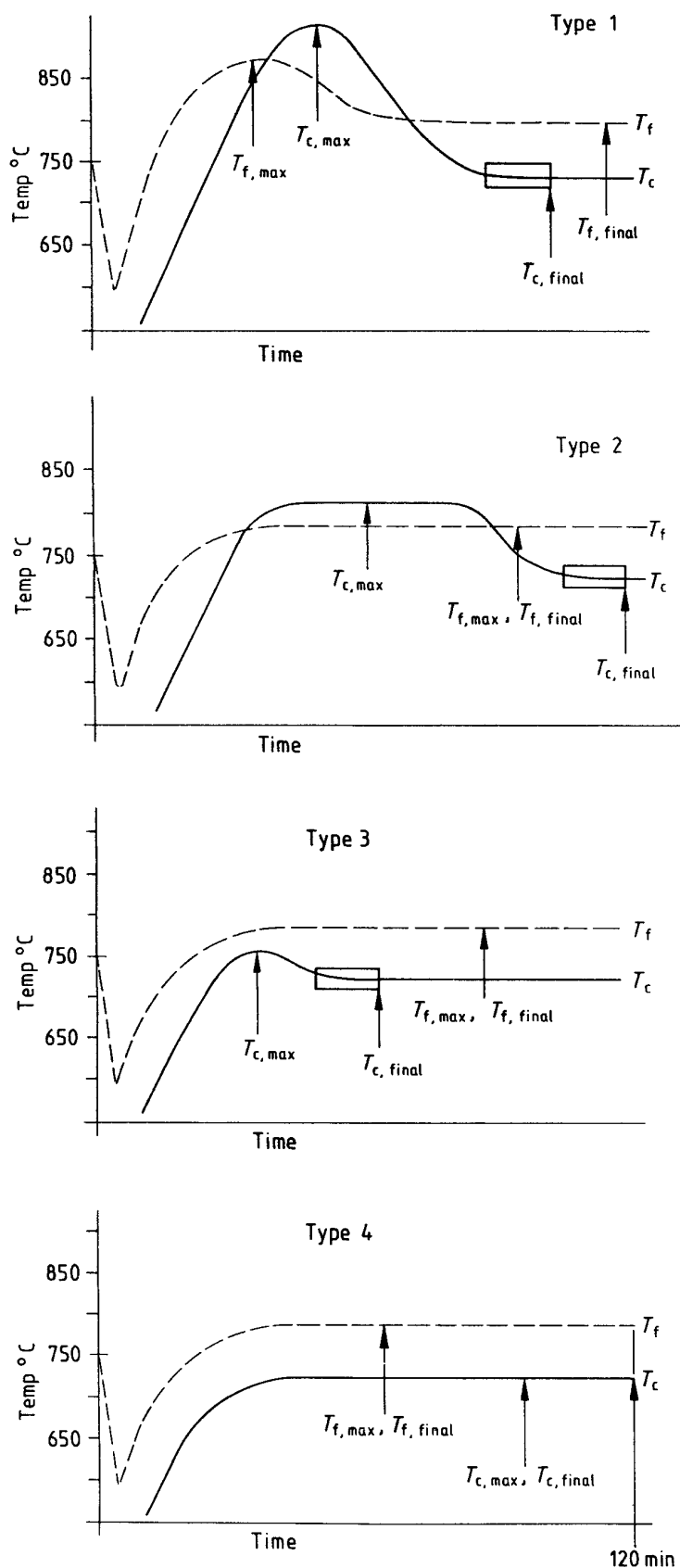


Figure 8 — Examples of final temperature equilibrium

## Appendix A Guidance for operators

**A.0 Introduction.** This appendix has been prepared to provide the operators and perhaps users of the results with background information on some of the requirements and procedures given in this method.

### A.1 Specimen construction and preparation

**A.1.1 Removal of coatings.** If an individual discrete material that forms part of a combination of materials (see clause 1) is tested, and the individual discrete material is faced with a surface coating such as paint, or a sheet material such as a veneer, this should be carefully and completely removed prior to testing. The report should, as specified in clause 8 f), contain full details of any coatings/veneers, etc. removed prior to test, and the relationship of the material to the combination of materials as a whole.

**A.1.2 Oversize materials.** If the material to be tested is greater than 52 mm thick after any pre-preparation, i.e. removal of coatings, veneers, etc., its thickness is reduced (see 2.2.1), ensuring that the finished faces are essentially smooth and parallel. The requisite cylindrical circular specimen should then be cut from the material using an appropriate method, such as a rotary cutter or lathe. Care should be taken to ensure that the density of low density soft or fibrous materials is not altered during the specimen preparation process.

**A.1.3 Undersize materials.** If the material to be tested is less than 48 mm thick after any pre-preparation, the specimen is made up by cutting an appropriate number of 45 mm diameter discs to produce a 50 mm high specimen layered horizontally. It may be necessary to cut a thin section from the material to provide precisely the height required. To reduce air circulation between the layers, two fine steel wires of nominal diameter 0.5 mm are used to bind the specimen together and, wherever possible, layers should be arranged so that the hot junction of the thermocouple lies within the material, not at an interface. The individual layers of material should not be glued together. (See 2.2.1.)

**A.1.4 Materials with uneven surfaces.** If the material to be tested has an embossed patterned or otherwise uneven surface, this should be removed by mechanical means to ensure that the layers of material fit closely together. Care should be taken to ensure that the density of low density soft or fibrous materials is not altered during the specimen preparation process.

### A.2 Furnace

**A.2.1 Correct orientation of furnace tube.** To ensure that, after rewinding, a furnace tube is inserted correctly into the insulating surround, the top of the tube has to be indicated clearly as required by 3.2.2. The correct orientation can be checked by using the temperature profile (see Figure 9), which may be obtained by measuring the furnace wall temperature of the tube on a single axis at 10 mm intervals with the contact thermocouple and its support (see 3.4.4).

**A.2.2 Initial heating of new furnace tube.** A new furnace tube should be heated carefully when used for the first time. A suitable procedure has been found to be to increase the furnace temperature in steps of about 200 °C, allowing 2 h of heating at each temperature.

If a tube is rewound with heating tape using a proprietary refractory cement to retain the windings in place, the cement should be carefully cured according to the cement manufacturer's instructions before insertion in the furnace casing.

**A.2.3 Insulation of furnace tube.** As required by 3.2.3, the annular space between the furnace tube and the outer casing is filled with magnesium oxide powder, initially weighed to give approximately the specified density. Settling of the insulation, such as may occur during transportation or movement of the equipment, or leakage following minor repair, should be made good by adding enough powder to refill the space. Care should be taken to maintain the bulk density requirement given in 3.2.3.

**A.3 Reflectivity of new thermocouples.** As required by 3.4.2, a new furnace thermocouple has to be artificially conditioned prior to use in order to reduce its reflectivity. This can be achieved by inserting the thermocouple into a specimen of resin-bonded glass fibre insulating material and subjecting this to the heating regime of the method for a period of 15 min.

### A.4 Calibration procedure

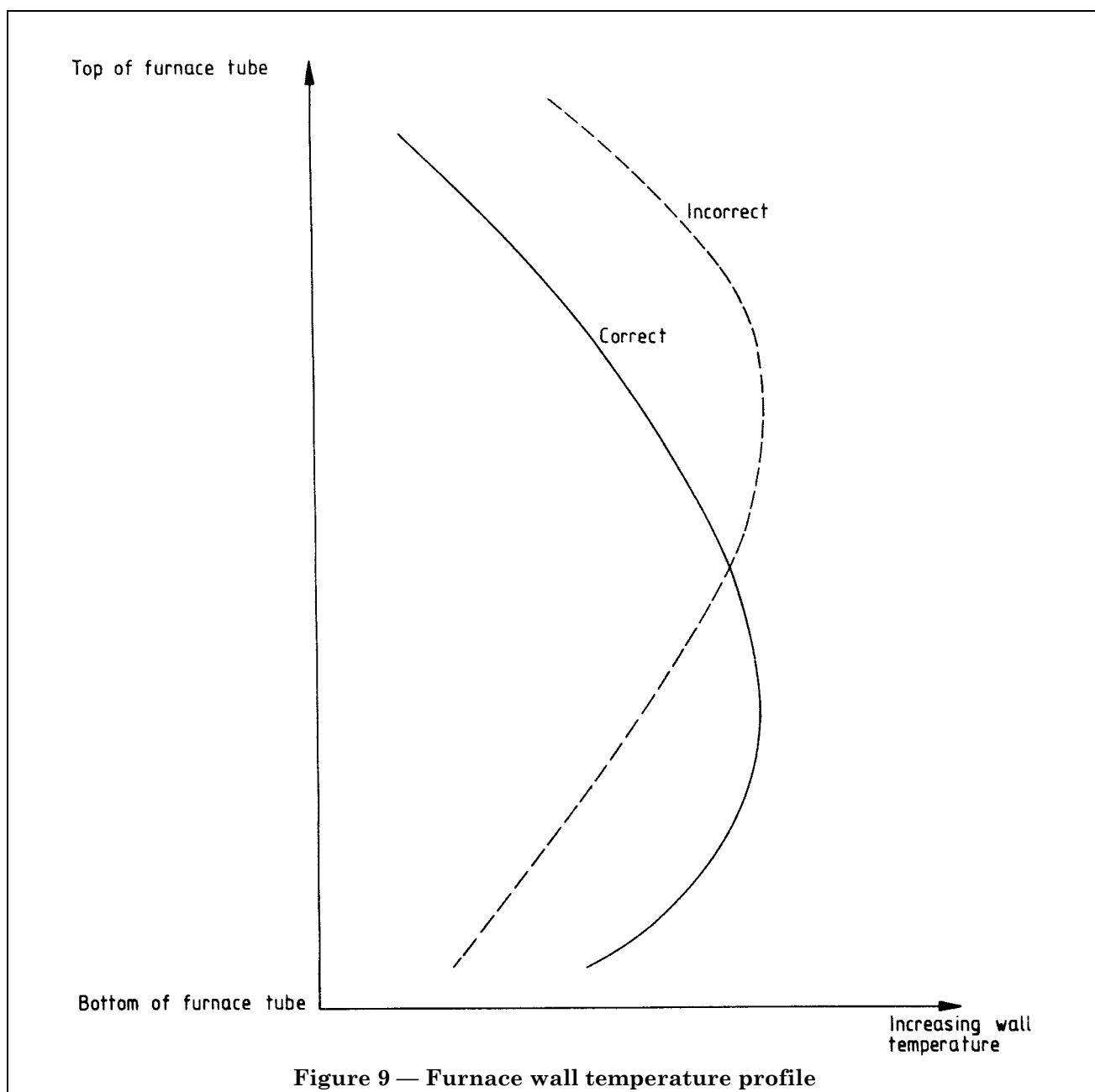
**A.4.1 Furnace stabilization.** In order to identify possible power overloading of the winding during the heating period, it is desirable to include an ammeter in the input circuit. With the furnace thermocouple at centre height registering  $750 \pm 5$  °C and the furnace wall temperature averaging  $835 \pm 10$  °C, the heating element should draw a current of approximately 9.5 A at approximately 100 V.

**A.4.2 Furnace wall temperature.** The temperature of the furnace wall as measured using the contact thermocouple (see Figure 6) is very dependent upon the contact achieved between the thermocouple sheath and the wall.

The positioning of the thermocouple at a given point should be adjusted until the maximum temperature is indicated; the temperature should be maintained stable for at least 5 min before recording the value. The process should be repeated at each of the positions required in 5.4.3 in order to calculate the average furnace wall temperature.

**A.5 Test procedure.** Flaming is sometimes difficult to identify. Some specimens exhibit only a continuous glow; this should not be timed but should, nevertheless, be noted under "Observations during test" (see 6.2, clause 8 and Appendix B).

Occurrence of flame from one part of the surface of the specimen may last for less than 5 s but if, during this time, flame appears from another area of the surface, this is considered to constitute a continuation of the original flaming and timing should be estimated accordingly. The duration of flaming is timed from the first ignition.



**Appendix B Summary test report**

Name of laboratory	Laboratory reference no.
Address	Date of test
Tel. no. (Telex)	

**Report in accordance with BS 476-11:1982 Method for assessing the heat emission from building materials**

Sponsor
Address
Manufacturer/supplier and address

Description of product	Trade name or reference no.
Construction of specimen	

Observations during test
Results:
number of specimens tested
mean furnace temperature rise, $T_F$ (in °C)
mean specimen temperature rise, $T_C$ (in °C)
mean duration of sustained flaming (in s)
mean density (in kg/m <sup>3</sup> )
mean mass loss (in %)

The results relate only to the behaviour of the specimens of the material under the particular conditions of the test. The results obtained on an individual material used in a combination should not be construed as reflecting the performance of the material combination as a whole, which may be influenced by the mechanism of combining the individual materials together, such as with adhesives. The results are not intended to be the sole criterion for assessing the potential fire hazard of the material in use.

NOTE Complete details can be obtained from the full report available from the sponsor.

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# Publications referred to

## Standards publications

BS 476, *Fire tests on building materials and structures*.

BS 476-10, *The principles and application of fire testing*<sup>4)5)</sup>.

PD 6508, *Detail drawings for the apparatus specified in BS 476-11:1982*<sup>4)5)</sup>.

ISO 1182, *Fire tests — Building materials — Non-combustibility test*<sup>4)</sup>.

## Legislation

Asbestos Regulations 1969<sup>4)</sup>.

Health and Safety at Work etc. Act 1974<sup>4)</sup>.

## Other publications

*Control and Safety guides*, Asbestos Research Council<sup>4)</sup>.

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<sup>4)</sup> Referred to in the foreword only.

<sup>5)</sup> In course of preparation.

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