

INTERNATIONAL STANDARD

ISO
10774

First edition
1992-11-01

Solid fuelled heaters — Test method for determining allowable clearances from combustible surfaces

iTeh STANDARD PREVIEW

*Radiateurs à combustibles solides — Méthode d'essai pour la
détermination des écartements permis des surfaces des combustibles*

ISO 10774:1992

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Reference number
ISO 10774:1992(E)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 10774 was prepared by Technical Committee ISO/TC 116, *Space heating appliances*, Sub-Committee SC 3, *Individual heating appliances*.

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Annex A of this International Standard is for information only.

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Solid fuelled heaters — Test method for determining allowable clearances from combustible surfaces

1 Scope

This International Standard specifies a method of test for establishing allowable clearances from combustible surfaces for free-standing and built-in domestic solid fuel-burning heaters which are able to be fully assembled prior to being transported to the installation site. It does not cover heaters which must be assembled *in situ* or heaters for installing into the firebox of concrete or masonry fireplaces.

The clearances established by these test methods are based upon acceptable fire test performance of the appliance from wood construction. It is recognized that the allowable temperature limits specified herein may not generally be appropriate for other construction materials, e.g. plastics such as polyvinyls, etc. Provisions for testing these materials to determine their acceptability are described.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 331:1983, *Coal — Determination of moisture in the analysis sample — Direct gravimetric method.*

ISO 1171:1981, *Solid mineral fuels — Determination of ash.*

ISO 1928:1976, *Solid mineral fuels — Determination of gross calorific value by the calorimeter bomb method, and calculation of net calorific value.*

ISO 3129:1975, *Wood — Sampling methods and general requirements for physical and mechanical tests.*

ISO 3130:1975, *Wood — Determination of moisture content for physical and mechanical tests.*

ISO/IEC GUIDE 54:1988, *Testing laboratory accreditation systems — General recommendations for acceptance of accreditation bodies.*

ISO/IEC GUIDE 55:1988, *Testing laboratory accreditation systems — General recommendations for operation.*

ASTM C 411:1982, *Standard test method for hot-surface performance of high-temperature thermal insulation*

ASTM D 1037:1987, *Standard method of evaluating the properties of woodbased fiber and particle panel materials.*

ASTM D 3175:1982, *Standard test method for volatile matter in the analysis sample of coal and coke.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 allowable material service temperature: Maximum temperature at which a material has been shown to comply with the requirements of clause 19.

3.2 appliance: Domestic solid fuelled heater, which may be free-standing or built-in.

3.3 built-in appliance: Appliance designed to be in contact with or built into a combustible building structure.

3.4 calorific value: Gross calorific value, determined in accordance with ISO 1928, corrected for

moisture content to give a value relative to the mass of the material on a dry basis.

3.5 chimney: Construction of noncombustible materials which incorporates a flue.

3.6 chimney connector: Pipe which ensures the passage of the products of combustion from the appliance to the chimney.

3.7 clearance: Shortest distance between specific parts, surfaces or objects.

3.8 coefficient of thermal insulance, M : For a particular material, the temperature difference divided by the density of heat flow rate, square metre kelvin per watt ($m^2 K/W$).

3.9 domestic: Noncommercial.

3.10 flue: Passage for conveying the products of combustion from within an appliance to the outside atmosphere.

3.11 firebox: That part of the appliance in which combustion normally takes place.

3.12 free-standing appliance: Appliance designed to be installed anywhere but not in a concrete or masonry fireplace nor built into a building structure.

3.13 floor protector: Construction to protect a floor from spilt ash, embers or heat generated by an appliance.

3.14 grate: Device for supporting fuel which, when installed in an appliance, allows combustion air to be supplied to the fuel through openings between the supports.

3.15 hearth: Floor area within the fire box of an appliance.

3.16 heat resistant material: Material with an allowable service temperature of 600 °C or more.

3.17 index of resistance to impact: Height of the ball drop in impact testing that just fails to produce a visible failure of the material on the side opposite the impact.

3.18 moisture content: Water content, expressed as a percentage of the dry weight, determined in accordance with:

- ISO 331 for coal;
- ISO 3130 for wood, on samples taken in accordance with ISO 3129 but not conditioned in accordance with 4.6.1 and 4.6.2 of ISO 3129:1975.

4 Appliance specification

An appliance submitted for test shall be provided with instructions for its installation, operation and maintenance, as well as the following documentation:

- a) name and address of the manufacturer;
- b) description, including the model name and design identification;
- c) full engineering drawings of the appliance showing details of overall dimensions, firebox dimensions, air inlet and flue gas outlet control means, baffle systems, grates, refractory and insulating materials, bypass dampers and overall shielding and coverings. Dimensions shall be toleranced.

5 Principle

The test method is based on installation of the appliance within a prescribed environment, firing using a specified procedure, monitoring of the temperatures at appropriate points and checking for compliance with given maxima.

6 Apparatus and calibrations

6.1 Apparatus

The following apparatus is required:

- a) a temperature-indicating system for measuring ambient temperature in the range 10 °C to 50 °C, with an accuracy of ± 2 °C;
- b) a number of thermocouples suitable for the calibration and test temperature ranges required and having a wire diameter not greater than 0,6 mm each;
- c) a temperature meter suitable for the calibration ranges required and with a thermocouple response range of 10 °C to 150 °C and an overall accuracy of ± 3 °C, for use with thermocouples on the test enclosure;
- d) a temperature meter with a thermocouple response range of 10 °C to 900 °C and an overall accuracy of ± 10 °C, for use with thermocouples on the appliance, on the flue or in the flue gas;
- e) a barometer capable of measuring the ambient barometric pressure to within 330 Pa;
- f) an anemometer for measuring ambient air velocities in the test enclosure over the range 0,1 m/s to 1 m/s, to within 0,1 m/s;

- g) a hygrometer capable of measuring relative humidity to within $\pm 5\%$;
- h) a test room and test enclosure, as defined in clauses 7 and 8, respectively;
- i) a balance for measuring fuel mass up to 20 kg with an accuracy of ± 10 g;
- j) a leak test system for measuring the flow rate (up to $1\text{ m}^3/\text{min}$ under standard conditions) through the appliance with an accuracy of $\pm 5\%$ while subjecting the appliance to a pressure of -25 Pa;
- k) a manometer capable of measuring flue draught in the range 0 Pa to 50 Pa with an accuracy of ± 5 Pa.

6.2 Calibrations

6.2.1 Traceability

All calibrations shall be traceable to the appropriate International Standards. All instruments and systems shall be calibrated to demonstrate accuracies as specified in 6.1 prior to the commissioning of a test enclosure, and thereafter at the frequencies prescribed below.

6.2.2 Temperature-measuring systems

All temperature-measuring systems shall be calibrated annually. Ice point and boiling point checks shall be made in accordance with clause 21 on selected exposed thermocouples before and after a testing programme on a particular appliance, to ensure that measured temperatures are within an overall accuracy of ± 3 °C.

6.2.3 Balance

The balance for fuel mass measurement shall be calibrated annually by performing a calibration with at least three points spanning the operational range of the instrument.

6.2.4 Barometer

The barometer shall be calibrated annually.

6.2.5 Anemometer

The anemometer shall be calibrated annually.

6.2.6 Hygrometer

The hygrometer shall be calibrated annually.

6.2.7 Leak test system

The leak test system shall be calibrated annually.

6.2.8 Calibration of the test enclosure

The enclosure should be calibrated annually in accordance with annex A.

7 Test room

7.1 The test room shall have an internal volume of not less than 60 m^3 and shall have ventilation capable of limiting the carbon monoxide concentration to a safe level during the test procedure. It is recommended that the carbon monoxide concentration should not be allowed to exceed 50 ppm. The air velocity shall not exceed 0,5 m/s in any part of the test room.

7.2 The ambient air temperature during the test shall be measured by a thermocouple that is shielded by being located centrally within a vertically orientated 150 mm length of aluminium-painted 50 mm diameter steel pipe open at both ends. This thermocouple shall be located 150 mm from the plane of one of the side walls of the test enclosure, inside the test enclosure, 1,2 m above the floor of the test enclosure and 2,1 m from the rear wall. The test enclosure ambient air temperature measured by this thermocouple shall remain within the range 20 °C to 35 °C during the test procedure.

For each thermocouple, except those above the test enclosure ceiling and the flue gas and appliance thermocouples, the ambient air temperature shall be subtracted from the temperatures recorded to obtain the temperature rise above ambient for that thermocouple.

Additional thermocouples of identical construction shall be used to measure the ambient temperature of succeeding stories of the attic space, and they shall be positioned vertically above the first thermocouple at heights 0,5 m above the ceiling joists. The temperature of the attic or storey space ambient air shall remain within the range 20 °C to 45 °C during the test procedure. For each thermocouple, except those on and below the test enclosure ceiling and the flue gas and appliance thermocouples, the temperature of the attic or storey space ambient air shall be subtracted from the temperatures recorded to obtain the temperature rise above ambient for that thermocouple.

During fire tests, temperatures on monitored thermocouples may not be deemed maximum if the ambient temperatures have increased more than 5 °C during the preceding hour.

7.3 The ambient air pressure and relative humidity in the test room shall be measured by instruments placed adjacent to the test enclosure and shielded from thermal radiation and convection. Ambient air pressure shall remain in the range 993 hPa to 1033 hPa during the test procedures.

7.4 The relative humidity in the test room shall not exceed 80 % during any part of the test procedure.

8 Test enclosure and appliance installation

Within the test room, the test shall be conducted in a test enclosure complying with the following specifications (see figure 1).

8.1 Structure

The test enclosure shall comprise two vertical walls meeting to form a corner at an angle of 90°, a horizontal floor meeting the lower edges of the two walls, and a horizontal ceiling situated, except as provided in 8.3, 2,4 m \pm 0,025 m above the floor to form corners with each of the two walls. The corners formed between the ceiling and the walls shall be sealed against air flow (paper masking tape is not considered satisfactory for this purpose). Provision shall be made to vary the lateral positioning of the

walls with respect to the floor and ceiling. The ceiling, walls and floor shall extend horizontally a minimum of 1,2 m beyond the perimeter of the appliance and shall be finished matt black over the inward-facing surfaces.

8.2 Construction

The walls of the test enclosure shall be constructed of nominal 100 mm by 50 mm timber studs at 450 mm nominal centres, with similar horizontal cross members at 800 mm nominal centres. The ceiling and floor of the test enclosure shall be supported by nominal 150 mm by 50 mm timber joists at 450 mm nominal centres. The joists shall run parallel to the rear wall of the test enclosure, and shall be joined by similar cross members at 800 mm nominal centres. The outer surfaces of the walls and floor shall be covered by 0,4 mm nominal thickness aluminium siding. The inner surface of the walls, floor and ceiling, and the outer surface of the ceiling shall be constructed of plywood from 15 mm to 20 mm thick. The space within the floor, walls and ceiling shall be uninsulated and sealed at the edges by timber of the same size as the studs or joists as appropriate. The floor of the test enclosure shall be spaced above the floor of the test room such that its top surface is nominally 300 mm above the floor of the test room.

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Dimensions in millimetres

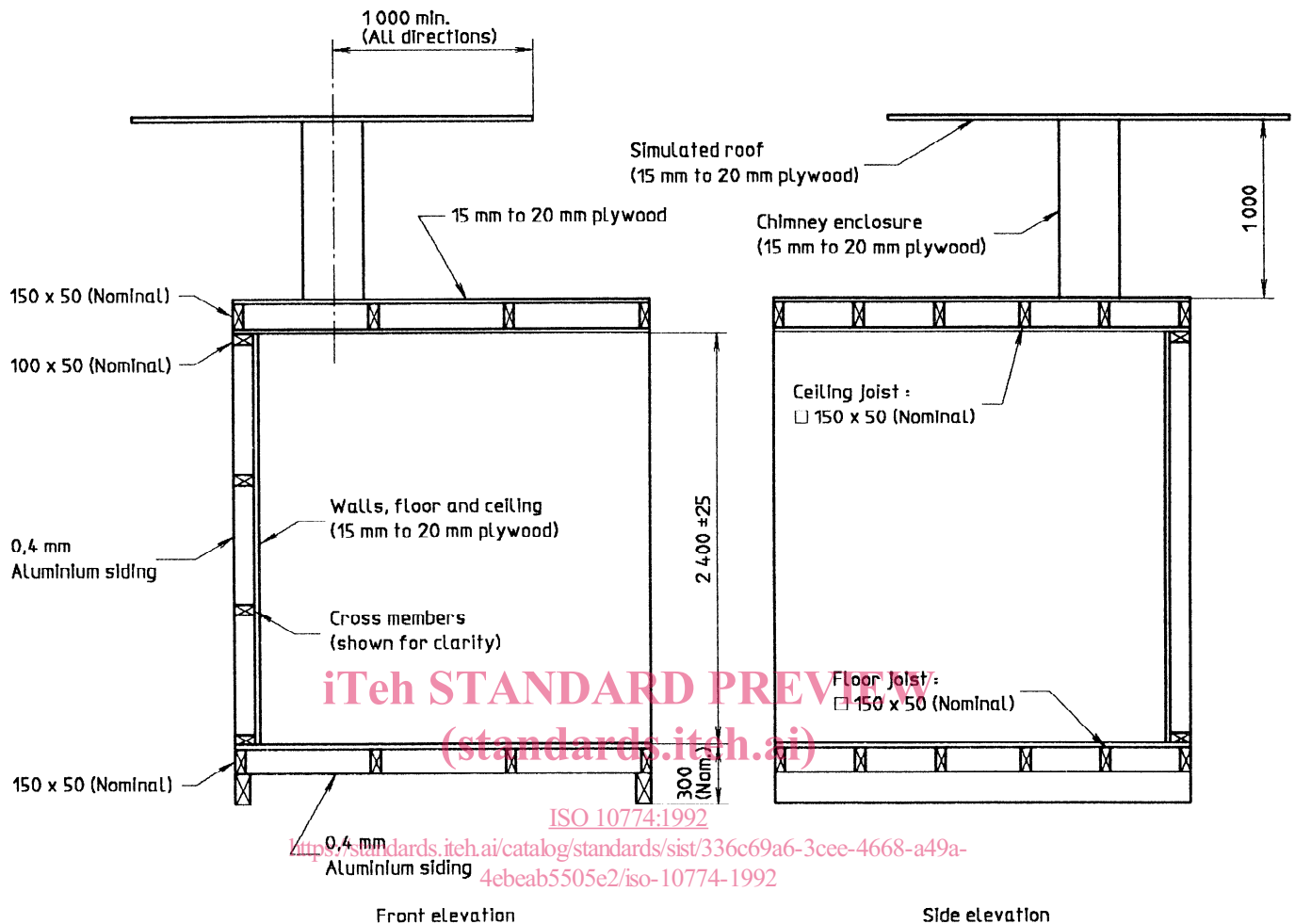


Figure 1 — Test enclosure

8.3 Confined space installations

Where an appliance is intended for installation in a confined space, e.g. ceiling height less than 2,25 m or in an alcove, the test enclosure shall simulate the intended installation. Any ceiling shall be horizontal.

8.4 Built-in appliances

8.4.1 The test enclosure shall simulate the intended installation.

NOTE 1 Manufacturers and testing agencies should be aware of different building, installation and testing requirements in various countries.

A vertical stud wall constructed in a fashion similar to the ceiling but using nominal 75 mm by 50 mm timber shall be placed around the appliance at the

minimum clearance the instructions allow. Unless the installation instructions prohibit the encasement of the chimney below the ceiling, the appliance chimney shall be enclosed with a rectangular encasement made of sheet material of the same type as the ceiling cladding, and the encasement shall be spaced from the chimney at the minimum distance specified in the instructions, or shall contact the chimney if no minimum clearance is specified. Except for the front face of the appliance, and unless the manufacturer's instructions prohibit their encasement, all other parts of the appliance shall be encased with sheet material of the same type as the ceiling cladding at the minimum clearance specified in the instructions, or at zero clearance if no clearance is specified. All junctions between floor, walls, ceiling and any of the sheet material specified above shall be sealed against air flow (paper masking tape is not considered satisfactory for this purpose).

The built-in appliance shall be tested using the maximum and minimum chimney heights specified by the manufacturer's instructions. Tests are to be conducted using an intermediate chimney height if the appliance then develops higher temperatures on monitored surfaces. Unless chimney elbows are prohibited in the installation instructions, the chimney is to be erected using the elbow configuration which develops highest temperatures on monitored surfaces.

8.4.2 Unless the appliance installation instructions prohibit the use of a mantelpiece, a simulated mantelpiece complying with the following shall be fitted:

- a) the mantelpiece shall be constructed of the same material as the ceiling cladding;
- b) the mantelpiece shall project forward from the vertical stud wall around the appliance, and shall project the maximum distance permitted by the installation instructions, or 250 mm if no distance is specified;
- c) the mantelpiece shall be painted matt black over the downward-facing surface;
- d) the mantelpiece shall extend beyond the sides of the appliance by the maximum distance permitted in the installation instructions, or 300 mm if no distance is specified;
- e) Unless mantelpiece columns are prohibited in the installation instructions, the mantelpiece shall be fitted with columns extending from the floor of the test enclosure to the underside of the mantelpiece. These columns shall be of the same material as the mantelpiece, shall be painted matt black, and shall project forward from the stud wall by the maximum distance permitted in the installation instructions, or 100 mm if no distance is specified. The columns shall be positioned at the minimum horizontal distance from the appliance permitted in the instructions, or shall be in contact with the appliance if no distance is specified;
- f) The vertical position of the mantelpiece shall be as determined by the minimum height allowed in the installation instructions, or at the height where the vertical stud wall abuts the appliance if no instructions are given.

8.5 Floor protectors

The appliance shall be installed directly on the floor of the test enclosure, unless installation on a floor protector is required in the installation instructions. Where a floor protector is specified, the appliance shall be installed on a floor protector of the mini-

imum size specified and the floor protector shall be constructed of heat resistant material with a coefficient of thermal insulance value not greater than that of the floor protector material with the lowest coefficient of thermal insulance value specified in the instructions, and it shall have a heat capacity not greater than that material. Appliances shall be installed on the floor or floor protector of the test enclosure at the minimum distance above the floor or floor protector permitted by any height-adjusting devices.

8.6 Chimney encasement in the attic

Unless the appliance installation instructions prohibit combustible materials in an attic space within a distance of 450 mm from the outside of the chimney, and unless the instructions prescribe a positive means for excluding combustible materials from this region, the chimney, where it passes through the attic, shall be encased on all sides with a rectangular encasement constructed of sheet material of the same type as the ceiling cladding, and the encasement shall be installed at the minimum clearance from the chimney casing specified in the instructions, or shall contact the chimney casing if no clearance is specified. Unless ventilation of the encasement is required in the installation instructions, and a means of providing such ventilation is supplied with the appliance, the encasement shall be sealed against air flow.

8.7 Ceiling or wall penetrations

Where a chimney or flue passes through the ceiling or wall, it shall be fitted in accordance with the manufacturer's instructions, or shall be fitted with zero clearance to the wall or ceiling materials if no instructions are provided. The chimney or flue shall be surrounded by material similar to the ceiling cladding, arranged in a square, positioned at the minimum clearance allowed in the instructions, or at zero clearance if no instructions are given.

8.8 Roof penetrations

Where required, a simulated roof penetration shall be installed at a height 1 m above the top ceiling cladding. This shall consist of a simulated roof of the same material as the ceiling cladding, extending horizontally a minimum of 1 m beyond the centre of the chimney in all directions. Where required, the chimney shall pass through the simulated roof, using construction as described in the instructions at the minimum clearance specified, or shall contact the simulated roof if no instructions are provided.

8.9 Chimney caps

A chimney cap shall be fitted.

8.10 Fans

Appliances which may be fitted with fans shall have the fans in position. Fans shall be used in a fashion which produces the highest temperatures on surfaces monitored during the test procedures.

8.11 Symmetry

Where a heater is asymmetrical or operates asymmetrically, the side wall of the test enclosure shall be adjacent to the hottest side of the appliance.

NOTE 2 In some appliances when a door is slightly ajar the radiant heat may affect the side wall temperatures.

8.12 Chimney height

For natural draught appliances, except built-in appliances, or where applicable for forced draught appliances, the chimney shall terminate at a height $4,6 \text{ m} \pm 0,1 \text{ m}$ above the floor of the test enclosure. The chimney for natural draught appliances shall terminate within the test room.

8.13 Exhaust gases

Provision shall be made to exhaust products of combustion to outside the test room, without inducing an increase in the natural draught in the appliance by more than $1,25 \text{ Pa}$.

8.14 Forced draught appliances

Appliances intended to operate under forced draught conditions shall be installed complete with their pressurizing system. During the test procedures, the appliance shall be run with the pressure difference between the combustion chamber air inlets and the flue gas outlet at the maximum specified in the operating instructions $\pm 5 \%$, or at $17 \text{ Pa} \pm 5 \%$ if no draught is specified.

8.15 Sealing of openings

All ventilation or cooling air openings shall be sealed against air flow, unless they are more than 30 mm above the floor of the test enclosure and so arranged that accidental closure is unlikely.

9 Placement of thermocouples

9.1 Thermocouples shall be attached to the inward-facing surfaces of the floor, walls and ceiling of the test enclosure, spaced at 150 mm in a square grid pattern covering at least all unexposed surfaces (see figure 2).

9.1.1 For the floor, the grid pattern shall have one thermocouple under the centre of the flue outlet for appliances with vertical flue outlets, or under the centre of the appliance combustion chamber for other appliances. Thermocouples shall also be attached on the floor directly underneath any appliance legs or feet.

9.1.2 For the rear wall, the datum of the grid pattern shall be the lower edge of the rear wall, and the centreline of the projection of the appliance chimney on the rear wall.

9.1.3 For the side wall, the datum of the grid pattern shall be the lower edge of the wall and the rearmost edge of the side wall, adjacent to the rear wall.

9.1.4 For the underside of the ceiling, the datum of the grid pattern shall be the centre of the flue.

NOTE 3 The exact location of thermocouples around the ceiling penetration will be determined by the smallest diameter of a ceiling support or collar of chimney systems meeting the national standard of the country for which acceptance of the test report is required. Grid thermocouples need not be placed within the circumference of this ceiling support or collar.

9.1.5 Thermocouples shall be attached to all inward-facing surfaces of the test enclosure in number and positions adequate to ensure that the highest temperatures are located. A radiometer or other device shall be used to ensure that the thermocouple grids on visible enclosure surfaces encompass the highest temperature locations; these grids shall be of sufficient size to ensure that the highest temperature locations fall at least one grid interval within the outer perimeter of the grid.

9.2 For appliances designed for zero clearance with any part of the test enclosure, thermocouples shall be attached:

- on the appliance at the location of intended point contact between the appliance and the test enclosure;
- on the appliance at 150 mm intervals along any intended line contact between the appliance and the test enclosure;
- on the appliance in a square grid pattern at 150 mm intervals on any area of contact between the appliance and the test enclosure.

Thermocouples shall be attached at the centre of the top of the appliance firebox, or as close to that point as can be practically achieved.