

Australian Standard™

Twin wall metal flues—Gas appliances

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Australian Standard™

Twin wall metal flues—Gas appliances

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PREFACE

This Standard was reviewed by the Standards Australia Committee, AG-006, Gas Installation Committee, to supersede AG 605—1987, *Approval Requirements For Twin Wall Metal Flues*. The Standard is republished without technical alterations.

The objective of this Standard is to provide manufacturers, designers, regulatory authorities, testing laboratories and similar organizations with uniform minimum requirements for the safety, performance and use of twin wall metal flues.

This Standard should not be regarded as a design specification or as an instruction manual.

In its preparation, consideration has been given to—

- (a) continuity of satisfactory operation;
- (b) the prevention of fire hazards, and explosions;
- (c) the prevention of injury to persons or property;
- (d) gas rules and regulations now in force; and
- (e) relevant International Standards.

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the appendix to which they apply. A ‘normative’ appendix is an integral part of the Standard, whereas an ‘informative’ appendix is only for information and guidance.

Statements expressed in mandatory terms in notes to tables and figures are deemed to be requirements of this Standard.

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SECTION 2 DESIGN AND CONSTRUCTION

2.1 MATERIALS**2.1.1 Non-combustible and corrosion-resistant**

A gas flue part shall be made of non-combustible corrosion-resistant materials. Metals shall not be used in combinations such as to cause detrimental galvanic action which will adversely affect any part of the assembly.

2.1.2 Sheet metal thickness

The minimum thickness of sheet metal, including any coatings, shall comply with Table 2.1, unless otherwise specified.

TABLE 2.1
MINIMUM THICKNESS OF SHEET METAL

Materials	mm
Aluminium alloys (1100, 3003) - inner pipe	0.30
Aluminium alloys (1100, 3003) - other use	0.40
Galvanized steel (275 g of zinc per m ²)	0.45
Aluminium coated steel (122 g per m ²)	0.45
Stainless steel (Type 430 and 300 Series)	0.30
Zinc/Aluminium alloy coated steel (150 g per m ²)	0.45

2.1.3 Aluminium alloys

Aluminium alloys containing more than 1.0% magnesium shall not be used if the reflectivity of the material is utilized to reduce fire hazard.

2.1.4 Durability and resistance

A flue gas conveying conduit shall be of material having durability and resistance to corrosion and heat equivalent to that of Type 1100 aluminium or Type 430 stainless steel conforming to the requirements contained herein. Other parts in contact with the flue gases or subject to condensation shall be of material having durability and resistance to corrosion and heat equivalent to Type 1100 aluminium or aluminium-coated steel.

2.2 CONSTRUCTION

An outer casing or other structural part (exclusive of the flue gas conveying conduit) whose failure would cause the gas flue to collapse or fail, shall be made of material having durability and resistance to damage, atmospheric corrosion and fire equivalent to that of galvanized steel having a coating of zinc of 275 (nominal) grams per square metre.

2.3 DESIGN**2.3.1 Nominal cross-sectional**

The nominal cross-sectional area of the flue gas passage of a flue pipe fitting shall be not less than that of the flue piping with which it is intended to be used.

2.3.2 Minimum wall gap

The gap between the two walls of a twin wall flue pipe section or flue pipe fitting shall not be less than 6 mm in width.

2.3.3 Joints

A joint shall—

- (a) be a tight fit (metal to metal) when made up in accordance with the manufacturer's instructions;
- (b) not materially reduce the capacity of the flue piping; and
- (c) be designed not to retain or leak condensation.

2.3.4 Top plate supports and spacers

A twin wall gas flue intended for installation within a wall cavity with other than zero clearance shall be provided with top plate supports designed to locate the flue in the wall cavity. Each length of flue shall include integral spacers that will maintain the minimum required clearance between the outer casing of the flue and the inner surfaces of walls. Such spacers are to be located so that, when lengths are joined, there will be spacers on both sides of and directly adjacent to each joint.

2.3.5 Ready attachment

Each part of a gas flue shall be designed for ready attachment of one to the other without requiring alteration, cutting, threading, drilling, welding or similar task by the installer, except that a length of flue pipe may be shortened by cutting if sufficient instructions and/or parts are available to enable the cut length to comply with these requirements.

2.3.6 Definite relationship between flue parts

Any parts of a flue which bear a definite relationship to any other for proper and safe use shall be arranged and constructed to permit them to be incorporated into the complete assembly only in the correct relationship with each other and without the need for alteration or alignment, or such parts shall be assembled and shipped from the factory as one element.

2.3.7 Assembly by manufacturers

Each gas flue part (such as a flue pipe section, elbow, coupling, tee etc.) shall be completely assembled by the manufacturer at the factory.

2.3.8 Spacer strength

All spacers shall have sufficient strength and bearing surface to maintain the required clearance between the flue pipe, parts of joists, ceiling and floor material, and the inner surface of walls.

2.3.9 Securing supports

A support assembly intended to be secured by nails or screws shall be arranged so that such holding means will be in shear.

2.3.10 Use of screws

Where screws are employed to field-join assemblies, the assemblies shall readily receive screws without being field-punched or field-drilled and a screw shall not extend into a flue inner conduit. Screws and instructions shall be supplied.

2.3.11 Damage free

An assembly intended to support the flue pipe shall not be damaged, nor shall the security of its attachment to the building structure be impaired.

2.4 MARKINGS

Each length of flue or component shall be clearly and permanently marked and such marking shall include the following:

- (a) Manufacturer's name and/or trade mark.

- (b) Type or designation.
- (c) Certificate of compliance number obtained from a certifying body.
- (d) Direction of flow, if applicable.

Markings shall remain legible and durable during normal handling and installation, e.g. to abrasion, humidity and temperature.

2.5 INSTRUCTIONS

Instructions in English shall be available, which shall include:

- (a) Type or designation.
- (b) Manufacturer's or agent's name and address.
- (c) Illustrations, directions and information for attaining proper and safe installation of the gas flue components including the details below:
 - (i) Parts required and the process for installing the gas flue, methods of support, and maintenance of clearances to wall, floor, ceiling, roof, joist construction and building insulation.
 - (ii) Methods and parts to be employed for maintaining ventilation and air circulation where required.
 - (iii) Any limitations with respect to installation and use, such as maximum height, the jointing of two or more parts to constitute a safe assembly etc.
 - (iv) Cutting and joining of lengths (where applicable).
 - (v) Essential external and internal dimensions.

SECTION 3 REQUIREMENTS FOR TYPE 1 TWIN WALL FLUES

3.1 COMPONENTS

Minimum components needed for approval of Type 1 flue systems:

- (a) Flue lengths of approximately 300, 900, 1200 and 1500 mm and an adjustable length unless the flue is designed to be cut.
- (b) Flue connection elbow and elbow housing for 75 mm stud walls.
- (c) Top plate flue support.
- (d) Adaptor for twin wall rectangular flue to circular flue.

3.2 SIZES

3.2.1 Inner conduit dimensions

The inner conduit of the flue or fitting shall have—

- (a) an internal cross-sectional area of not less than 70 cm²; and
- (b) internal dimensions of—
 - Width $225 \begin{smallmatrix} +5 \\ -0 \end{smallmatrix}$ mm
 - Depth $33 \begin{smallmatrix} +3 \\ -0 \end{smallmatrix}$ mm

3.2.2 External dimensions

The assembled joint shall be capable of passing through a rectangular aperture measuring 65 mm × 270 mm.

3.2.3 Dimensions diagram

A flue connection elbow and elbow housing shall incorporate the dimensions shown in Figure A1.

3.3 SUPPORT PLATES

3.3.1 Top plate supports

Top plate supports shall be—

- (a) capable of positively locating the twin wall flue within the wall cavity; and
- (b) made of at least 1 mm gauge galvanized steel, stiffened along the longitudinal edges with a minimum turn up of 6 mm. The longitudinal length shall not be less than 600 mm.

3.3.2 Header plates

Header plates shall be capable of positively—

- (a) locating the twin wall flue within the wall cavity; and
- (b) locating and retaining the appliance flue outlet.

3.4 FLUE CONNECTION ELBOW AND ELBOW HOUSING

3.4.1 Flue connection elbow

A flue connection elbow shall be made of stainless steel with a minimum thickness of 0.60 mm or material having equivalent strength.

3.4.2 Flue connection elbow housing

A flue connection elbow housing shall be—

- (a) made of galvanized steel with a minimum thickness of 0.80 mm, or a material having equivalent strength, and shall meet the requirements of Clause 2.2; and
- (b) be capable of positively—
 - (i) locating and retaining the twin wall flue within the wall cavity; and
 - (ii) locating the flue connection elbow.

SECTION 4 REQUIREMENTS FOR TYPE 2 TWIN WALL FLUES

4.1 COMPONENTS

Minimum components needed for approval of Type 2 flue systems:

- (a) Flue lengths of approximately 300, 900, 1200 and 1500 mm and an adjustable length unless the flue is designed to be cut.
- (b) Flue connection elbow and elbow housing for 95 mm stud wall.
- (c) Adaptors to suit circular flue and flue connection elbow.

4.2 SIZES

4.2.1 Inner conduit dimensions

The inner conduit of the flue or fitting shall have an internal cross-sectional area of not less than 70 cm².

4.2.2 External dimensions

An assembled joint shall be capable of passing through a rectangular aperture measuring 89 mm × 270 mm.

4.2.3 Internal minimum

No internal dimension of the cross-section of an oval or rectangular flue pipe or fitting shall be less than 35 mm.

4.2.4 Dimensions diagram

A flue connection elbow shall incorporate the dimensions shown in Figure A1.

4.3 SUPPORT PLATES

4.3.1 Top plate supports

Top plate supports shall be—

- (a) capable of positively locating the twin wall flue within the wall cavity; and
- (b) made of at least 1 mm gauge galvanized steel, stiffened along the longitudinal edges with a minimum turn up of 6 mm. The longitudinal length shall not be less than 600 mm.

4.3.2 Header plates

Header plates shall be capable of positively—

- (a) locating the twin wall flue within the wall cavity; and
- (b) locating and retaining the appliance flue outlet.

4.4 FLUE CONNECTION ELBOW AND ELBOW HOUSING

4.4.1 Flue connection elbow

A flue connection elbow shall be made of stainless steel with a minimum thickness of 0.60 mm or material having equivalent strength.

4.4.2 Flue connection elbow housing

A flue connection elbow housing shall be—

- (a) made of galvanized steel with a minimum thickness of 0.80 mm or a material having equivalent strength and shall meet the requirements of Clause 2.2.
- (b) capable of positively—
 - (i) locating and retaining the twin wall flue within the cavity; and
 - (ii) locating the flue connection elbow.

SECTION 5 REQUIREMENTS FOR TYPE 3 TWIN WALL FLUES

5.1 COMPONENTS

Minimum components needed for approval of Type 3 flue systems:

- (a) Flue lengths of approximately 300, 900, 1200 and 1500 mm and an adjustable length unless the flue is designed to be cut.
- (b) 45° flue elbow.
- (c) Draught diverter connector which shall be capable of disconnection in service without alteration to the flue flashing.
- (d) Flue cowl connector.
- (e) Ceiling rings to give clearances between the flue and the ceiling.
- (f) Adaptors for standard flue connection, if applicable.

5.2 SIZES

The internal diameter of a circular flue pipe and matching fittings shall not be less than the nominal diameter of the flue.

S E C T I O N 6 P E R F O R M A N C E

6.1 GENERAL

An assembly intended to support the flue shall not damage or impair the security of its attachment to the building structure.

6.2 OPERATING CHARACTERISTICS

6.2.1 Adjacent surface temperature

When installed according to the manufacturer's instructions in or against 75 mm or 95 mm walls whichever is applicable, and as close as any integral spacers will permit, the temperature 1.6 mm below the adjacent surfaces shall not exceed 50°C above ambient with a flue gas temperature of 270°C above ambient.

6.2.2 Temperature test outcomes

After being subjected to the temperature test, the flue assembly shall satisfy the following:

- (a) No part of the gas flue shall be damaged or permanently distorted to an extent that it or the assembly will not continue to function as intended.
- (b) The effectiveness of any required protective coating or finish on metal parts shall not be impaired.
- (c) The reflectivity of a surface shall not be impaired if the reflectivity of such a surface is utilized to reduce fire hazard.
- (d) The effectiveness of insulating material shall not be reduced.

6.3 MECHANICAL STRENGTH

6.3.1 Joint separation

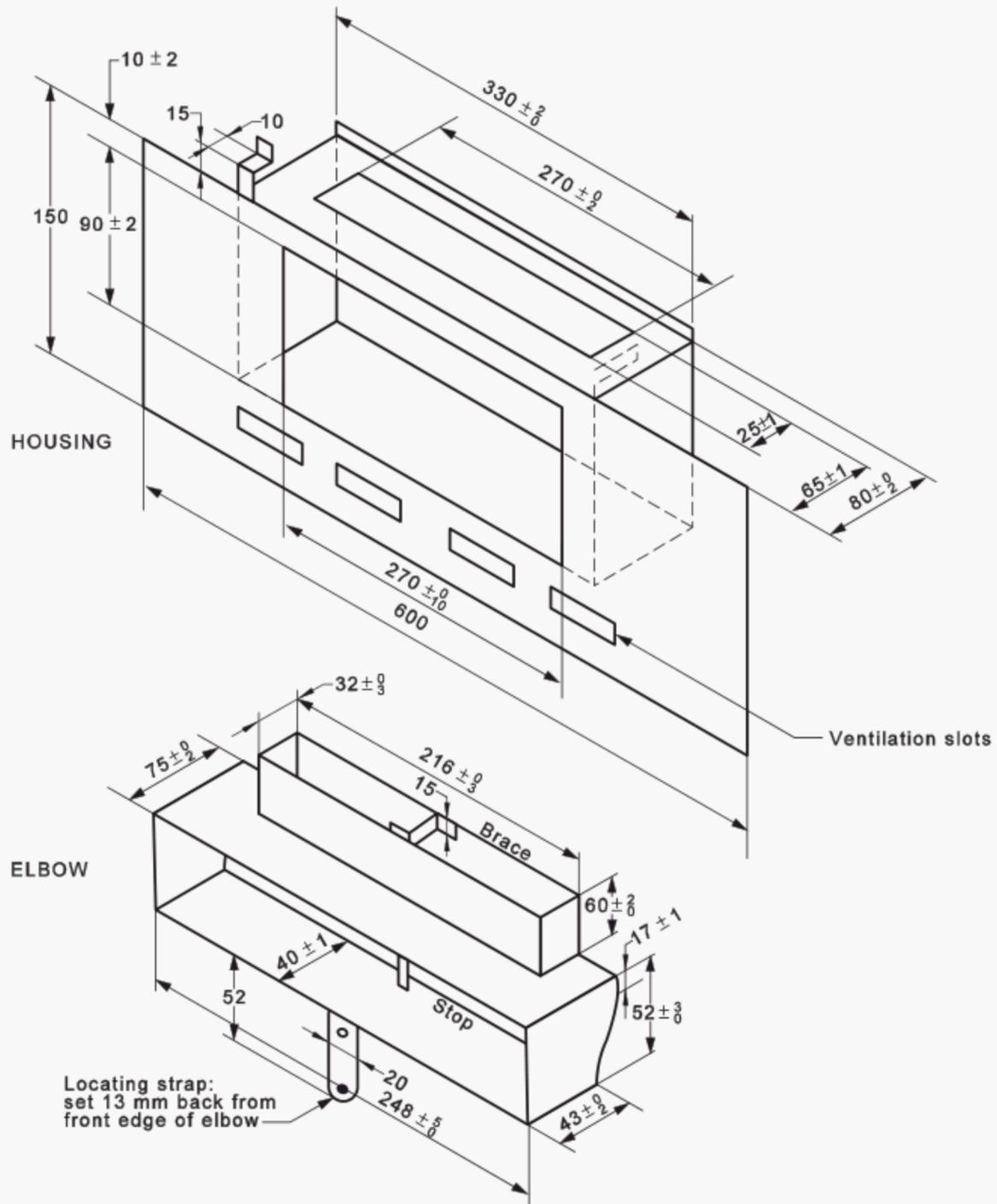
Joints between parts of the flue shall not separate if lifted at the top section with a mass of 40 kg suspended from the bottom section and held for 5 min.

6.3.2 Impact damage

For exposed flues, sections shall not become unsafe for use by separation or damage when subjected to impacts from a 9 kg sandbag released from a specified distance away from its vertical at-rest position.

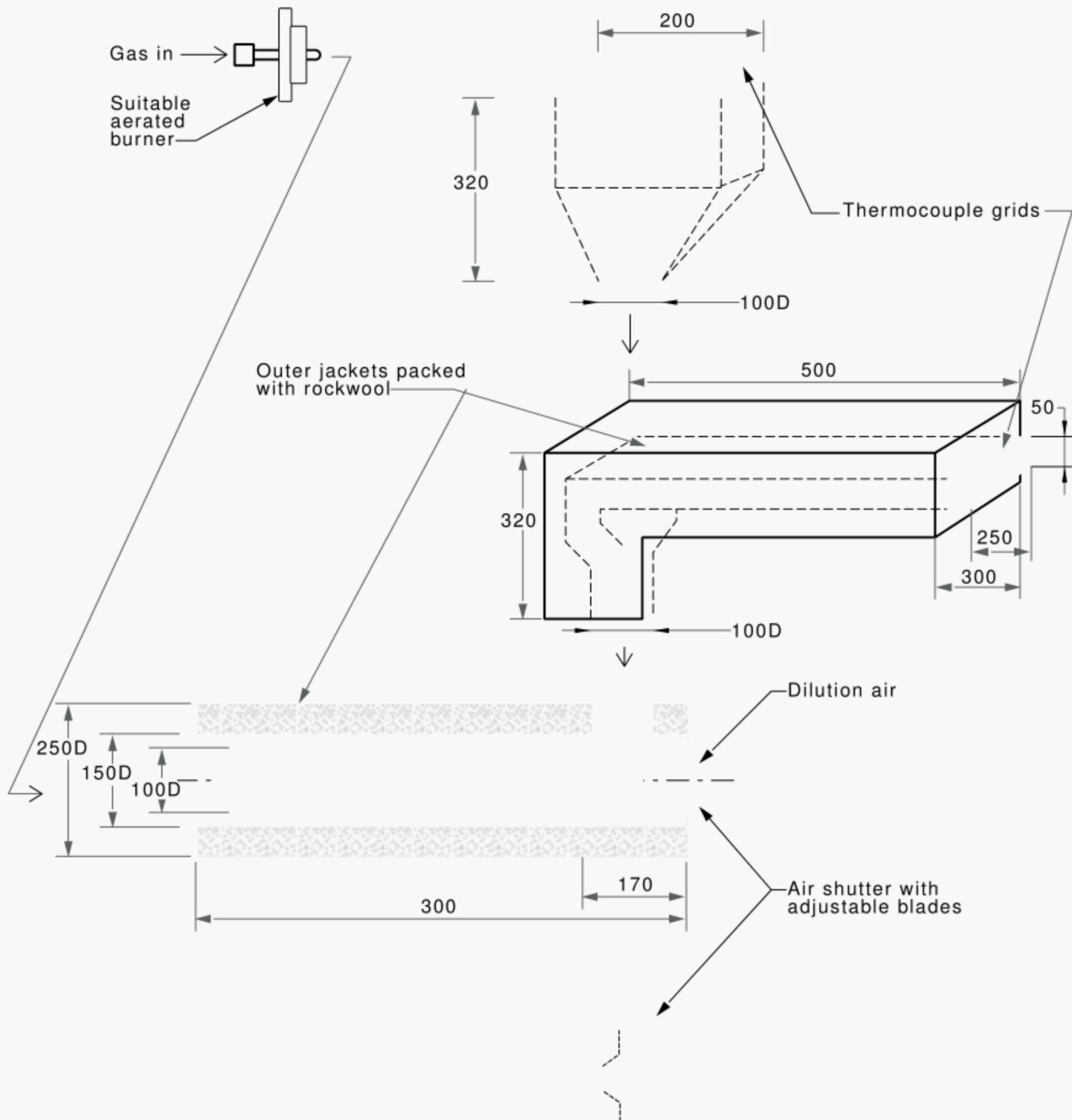
APPENDIX A
FIGURES
(Normative)

Figure	Description
A1	Flue connection elbow and elbow housing
A2	Flue gas generator
A3	Test structure for twin wall flue
A4	Connections from flue gas generator to test flue
A5	Thermocouple grid pattern for flue gas temperature test structure
A6	Thermocouple pattern for test structure
A7	Swinging impact apparatus



DIMENSIONS IN MILLIMETRES

FIGURE A1 FLUE CONNECTION ELBOW AND ELBOW HOUSING



DIMENSIONS IN MILLIMETRES

FIGURE A2 FLUE GAS GENERATOR

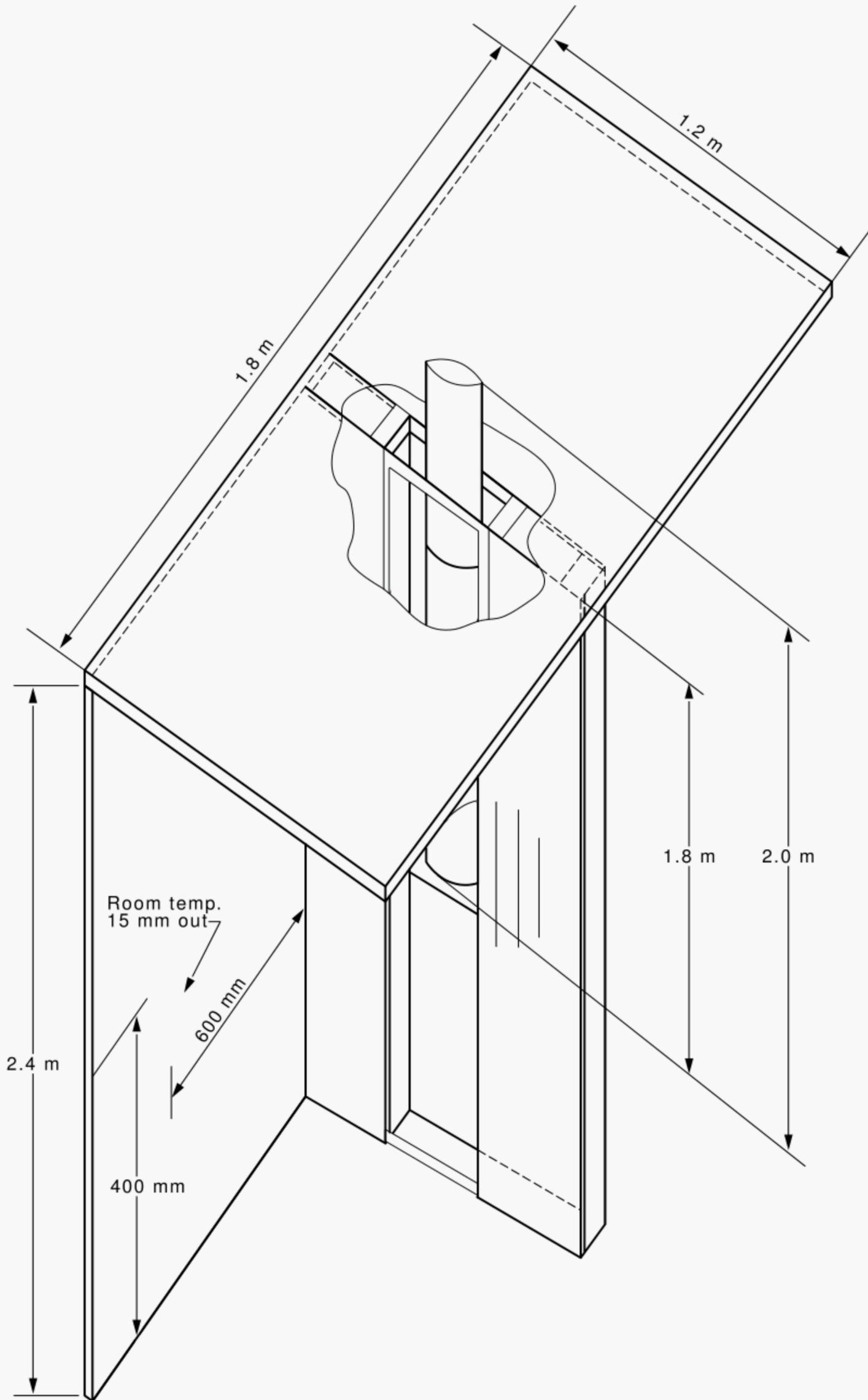
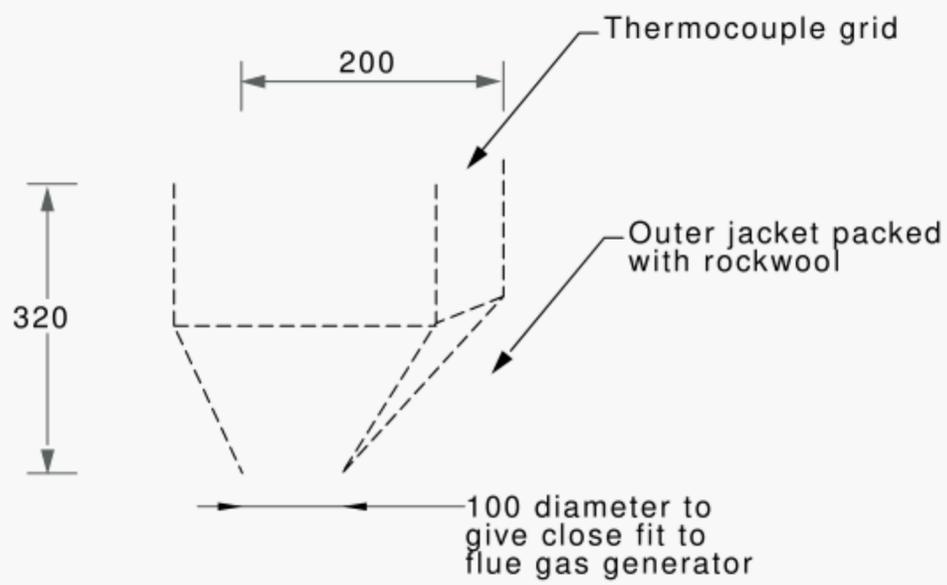
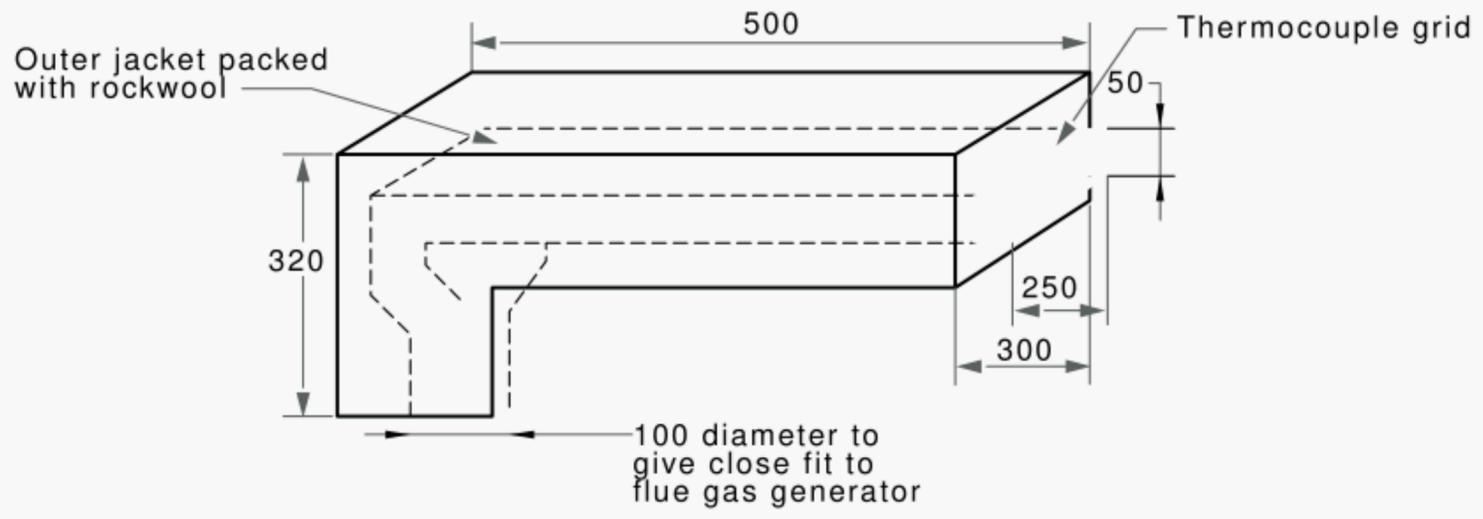


FIGURE A3 TEST STRUCTURE FOR TWIN WALL FLUE



DIMENSIONS IN MILLIMETRES

FIGURE A4 CONNECTIONS FROM FLUE GAS GENERATOR TO TEST FLUE

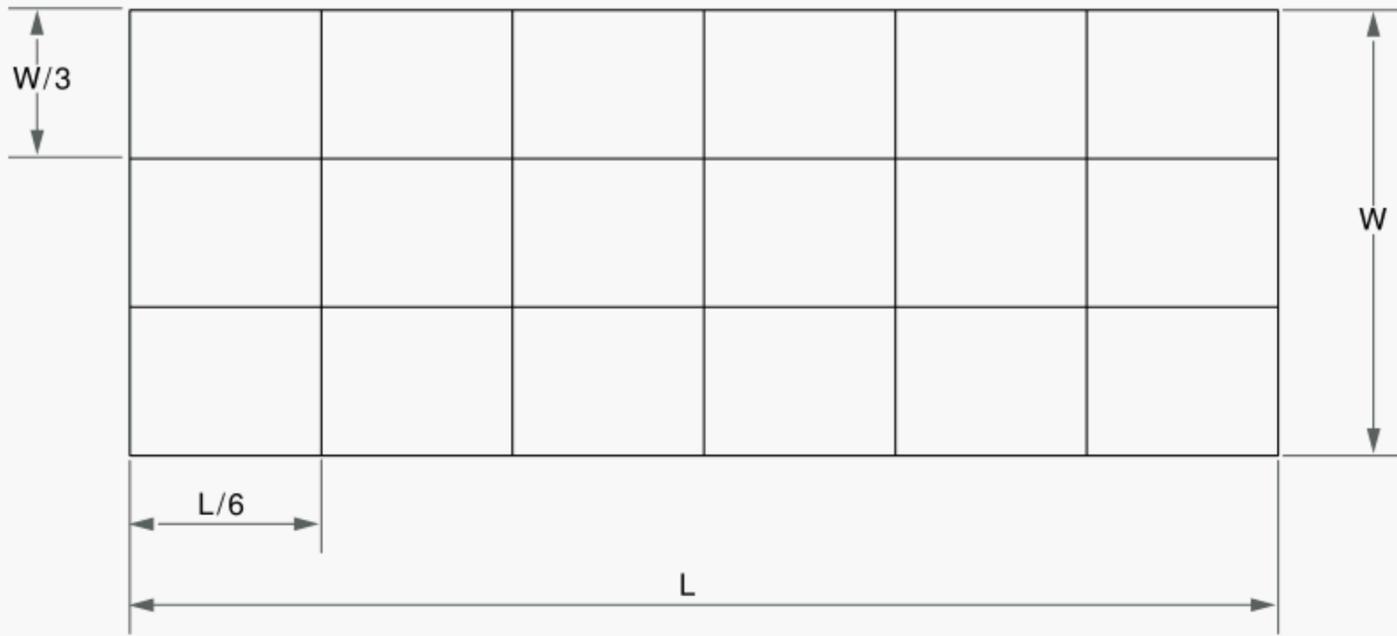
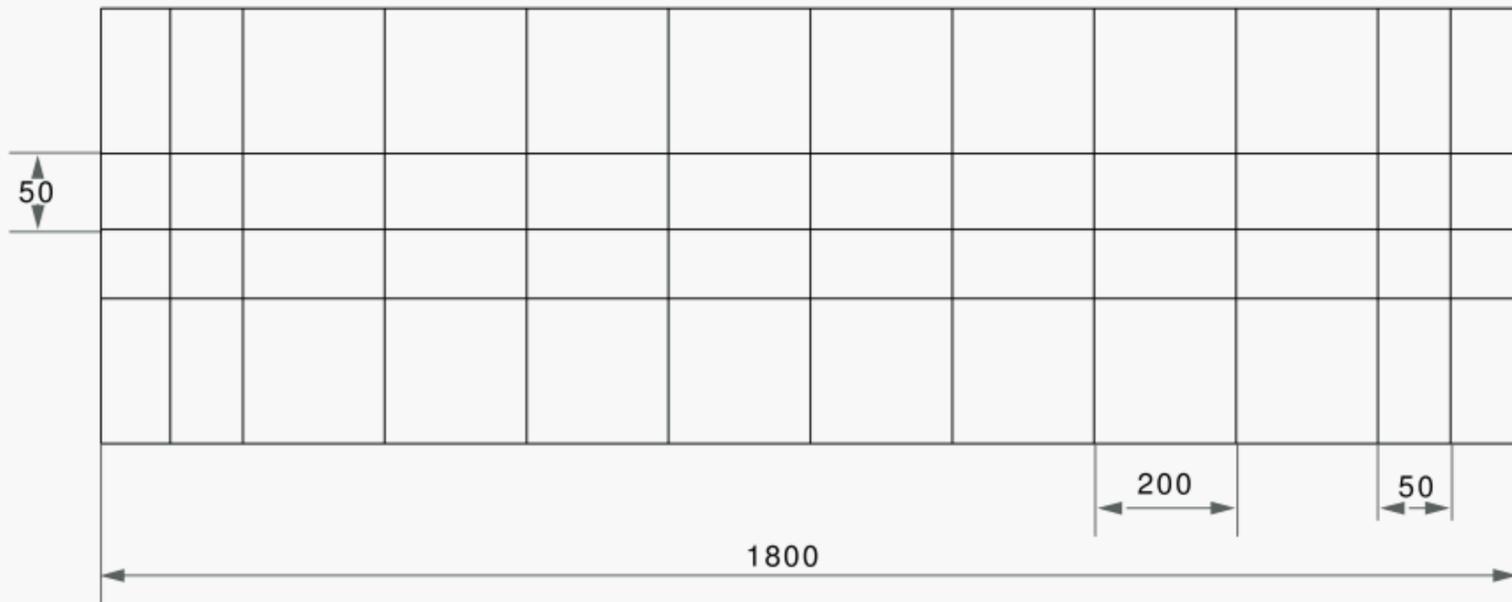


FIGURE A5 THERMOCOUPLE GRID PATTERN FOR FLUE GAS TEMPERATURE TEST STRUCTURE



DIMENSIONS IN MILLIMETRES

FIGURE A6 THERMOCOUPLE PATTERN FOR TEST STRUCTURE

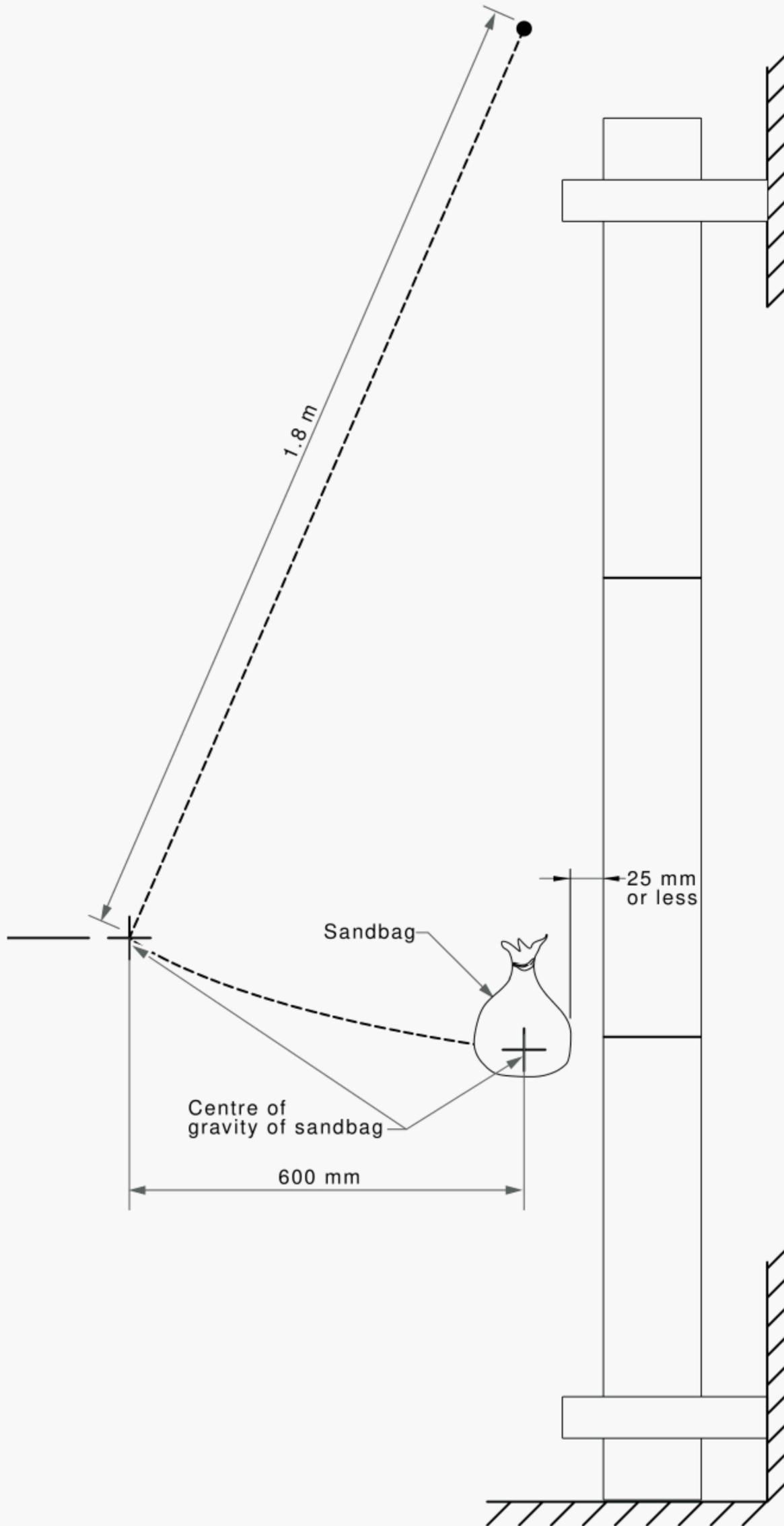


FIGURE A7 SWINGING IMPACT APPARATUS

APPENDIX B
METHODS OF TEST
(Normative)

B1 M.O.T. 2.4 – 88 MARKINGS AND LABELS**B1.1 SCOPE**

These tests apply to all permanent markings and labels specified in Clause 2.4.

B1.2 METHOD

The legibility of all markings and labels is checked by rubbing with material soaked in water and kerosene before and after a heat soak test in an oven. The adhesion of self-adhesive labels is checked before and after the heat test and immersion in water.

B1.3 APPARATUS

- 1 Oven suitable for maintaining a temperature of 120°C ±5°C.
- 2 Water bath.

B1.4 MATERIALS

- 1 Water.
- 2 Kerosene.
- 3 Suitable material such as cotton or linen.
- 4 Samples of markings and labels, affixed to suitable backing plates e.g. enamelled steel, if of the self-adhesive type.

B1.5 PROCEDURE

- 1 Check self-adhesive labels for good adhesion and no lifting at edges.
- 2 Rub markings for 15 s with finger pressure applied to material soaked in water and check for legibility.
- 3 Rub markings for 15 s with finger pressure applied to material soaked in kerosene and check for legibility.
- 4 Place one sample of markings and label in an oven at a temperature of 120°C for 72 h.
- 5 Remove samples from oven, allow to cool and check for adhesion and legibility as in Steps 1, 2 and 3.
- 6 Immerse one sample of markings and label in water for 24 h.
- 7 Remove sample from water, dry and check for adhesion and legibility as in Steps 1, 2 and 3.

B1.6 RESULT

The markings and self-adhesive labels comply with the requirements if good legibility of markings and adhesion of labels is obtained throughout the tests.

B2 M.O.T. 6.2-1-94 TEMPERATURE HAZARD AND HEAT RESISTANCE (TYPE 1 AND TYPE 2)

B2.1 SCOPE

This test applies to all Type 1 and Type 2 twin wall flue systems for appliances with a gas consumption not exceeding 50 MJ/h.

B2.2 METHOD

The twin wall flue and fittings to be tested are installed in a suitable test structure. Hot flue gases are passed up the flue, temperature measurements of the structure are determined at equilibrium and the flue assembly examined for damage.

B2.3 APPARATUS

- 1 Flue gas generator capable of producing flue gases at $270^{\circ}\text{C} \begin{smallmatrix} +10^{\circ}\text{C} \\ -0^{\circ}\text{C} \end{smallmatrix}$ above ambient (see Figure A2).
- 2 A vertical assembly, composed of standard flue sections and other furnished components erected according to manufacturer's installation instructions and as close as any integral spacers will permit, using all functional parts such as support bar plate, top plate support, etc.

The lengths selected shall be such that at least one joint between sections will be located within the vertical test enclosure.

- 3 A test wall section to carry the flue assembly, constructed in accordance with commonly accepted building practices (see Figure A3).

The test wall section is to be made of clean timber sheathed on both sides with 9 mm plasterboard. The timber shall be for—

Type 1 flues: $46 \text{ mm} \pm 1 \text{ mm} \times 71 \text{ mm} \pm 1 \text{ mm}$

Type 2 flues: $46 \text{ mm} \pm 1 \text{ mm} \times 95 \text{ mm} \pm 1 \text{ mm}$.

A steel header plate or flue connection elbow housing, as appropriate, similar to that shown in Figure A1 is to be secured in the stud space at the height shown in Figure A3. The 9 mm plasterboard sheathing is to overlap the header plate or is fitted under the elbow housing.

Top plate supports, and base plates, as regularly furnished with the flue, are to be installed at the ceiling and at the header plate/elbow housing, respectively, in accordance with the manufacturer's instructions.

Intermediate flue sections are to be placed inside the wall cavity against one of the enclosing walls as close as the integral spacers will permit.

This test structure is to be erected within a room which is reasonably free of draughts and the flue is to exhaust into the same space or into a space freely communicating with that from which the combustion air is taken.

The room temperature shall not increase by more than 10°C during the complete test.

- 4 Thermocouples of 24 AWG and with an accuracy of $\pm 2^{\circ}\text{C}$ or better, placed in 8 mm diameter holes drilled in from the outside of the plasterboard used for sheathing the wall cavity. The holes shall be flat bottomed and drilled to within 1.6 mm of the plasterboard surface in a grid pattern (see Figure A6). The thermocouples are placed in the holes and bent at right angles to lie as flat as possible on the bottom of the holes. The point at which the wires first make electrical contact to form the junction shall be at least 4 mm from the bend and the thermocouples shall be held in place by an electrically insulating cement.

Additional thermocouples are to be placed in the studs and at other locations if deemed necessary.

- 5 A thermocouple grid (see Figure A5) is fitted inside the flue gas generator as shown in Figure A4 to measure the flue gas temperature. The thermocouple wire shall be 24 AWG or thinner, with an accuracy of $\pm 2^{\circ}\text{C}$ or better.
- 6 Shielded thermocouple to measure room temperature with an accuracy of $\pm 2^{\circ}\text{C}$. The thermocouple shall be located centrally within a 150 mm length of aluminium-painted 50 mm steel pipe, open at both ends.
- 7 Temperature indicator with a switching arrangement and with an accuracy of $\pm 2^{\circ}\text{C}$.

B2.4 PREPARATION OF APPARATUS

- 1 Terminate the vertical test flue at least 2 m above the header plate/elbow housing. If a test in a two-storey test structure is to be conducted, then a height of 5 m is used with the additional increment encased by a joist and floor area and an enclosure similar to that shown in Figure A3. The additional enclosure is to be placed directly above the one below.

- 2 Attach thermocouples to the surfaces of the flue parts in contact with structural elements.

Where structural elements are adjacent to flue parts, the thermocouples shall have 12 mm of wire exposed and be secured by staples over insulated portions of the wire, the junctions being depressed flush with the surface and held in thermal contact with the surface by paper masking tape or its equivalent.

- 3 Locate the shielded thermocouple on the horizontal plane of the header plate/elbow housing and a horizontal plane 1 m above each additional floor level, mounted on the side wall 400 mm above floor level, 600 mm horizontally from the flue and protruding 15 mm perpendicularly to the side wall (see Figure A3).

NOTE: The thermocouple should be protected from direct radiation.

- 4 Connect the flue gas generator outlet to the test flue inlet by means of galvanized flue pipe having a diameter equivalent to that of the flue inlet.

This connection is to be made using a galvanized flue section and fittings (see Figure A4).

The flue and fittings are to be insulated.

B2.5 PROCEDURE

- 1 With the test structure and flue assembly at room temperature, ignite the flue gas generator and set to a nominal gas consumption of 15 MJ/h.
- 2 Adjust the induced air flow (see Figure A2) so that the flue gas temperature is 270°C above ambient temperature at the test flue entry.
- 3 Check the flue gases for complete combustion in the flue gas generator combustion chamber.
- 4 Measure and record room temperature (shielded thermocouple).
- 5 Measure and record surface temperatures.
- 6 Continue test until temperature equilibrium is obtained.
- 7 Allow to cool, dismantle and inspect the test flue.
- 8 Calculate surface temperature rise by subtracting measured room temperature from actual surface temperature.

Additional thermocouples are to be placed in the studs and at other locations if deemed necessary.

- 5 A thermocouple grid (see Figure A5) is fitted inside the flue gas generator as shown in Figure A4 to measure the flue gas temperature. The thermocouple wire shall be 24 AWG or thinner, with an accuracy of $\pm 2^{\circ}\text{C}$ or better.
- 6 Shielded thermocouple to measure room temperature with an accuracy of $\pm 2^{\circ}\text{C}$. The thermocouple shall be located centrally within a 150 mm length of aluminium-painted 50 mm steel pipe, open at both ends.
- 7 Temperature indicator with a switching arrangement and with an accuracy of $\pm 2^{\circ}\text{C}$.

B2.4 PREPARATION OF APPARATUS

- 1 Terminate the vertical test flue at least 2 m above the header plate/elbow housing. If a test in a two-storey test structure is to be conducted, then a height of 5 m is used with the additional increment encased by a joist and floor area and an enclosure similar to that shown in Figure A3. The additional enclosure is to be placed directly above the one below.

- 2 Attach thermocouples to the surfaces of the flue parts in contact with structural elements.

Where structural elements are adjacent to flue parts, the thermocouples shall have 12 mm of wire exposed and be secured by staples over insulated portions of the wire, the junctions being depressed flush with the surface and held in thermal contact with the surface by paper masking tape or its equivalent.

- 3 Locate the shielded thermocouple on the horizontal plane of the header plate/elbow housing and a horizontal plane 1 m above each additional floor level, mounted on the side wall 400 mm above floor level, 600 mm horizontally from the flue and protruding 15 mm perpendicularly to the side wall (see Figure A3).

NOTE: The thermocouple should be protected from direct radiation.

- 4 Connect the flue gas generator outlet to the test flue inlet by means of galvanized flue pipe having a diameter equivalent to that of the flue inlet.

This connection is to be made using a galvanized flue section and fittings (see Figure A4).

The flue and fittings are to be insulated.

B2.5 PROCEDURE

- 1 With the test structure and flue assembly at room temperature, ignite the flue gas generator and set to a nominal gas consumption of 15 MJ/h.
- 2 Adjust the induced air flow (see Figure A2) so that the flue gas temperature is 270°C above ambient temperature at the test flue entry.
- 3 Check the flue gases for complete combustion in the flue gas generator combustion chamber.
- 4 Measure and record room temperature (shielded thermocouple).
- 5 Measure and record surface temperatures.
- 6 Continue test until temperature equilibrium is obtained.
- 7 Allow to cool, dismantle and inspect the test flue.
- 8 Calculate surface temperature rise by subtracting measured room temperature from actual surface temperature.

B3 M.O.T. 6.2-2-94 TEMPERATURE HAZARD AND HEAT RESISTANCE (TYPE 3)

B3.1 SCOPE

This test applies to all Type 3 twin wall flue systems.

B3.2 METHOD

The twin wall flue and fittings to be tested are installed in a corner of a suitable test structure. Hot flue gases are passed up the flue, temperature measurements of the structure are determined at equilibrium and the flue assembly examined for damage.

B3.3 APPARATUS

1 Flue gas generator (similar to Figure A2) capable of producing flue gases at 270°C $+10^{\circ}\text{C}$ -0°C above ambient and having a gas consumption equivalent to 30% of the flue gas carrying capacity of the flue.

2 A vertical assembly, composed of standard flue sections and other furnished components erected according to manufacturer's installation instructions and as close as any integral spacers will permit, using all functional parts.

The lengths selected shall be such that at least one joint between sections will be located within the vertical test section.

3 A test wall section including a cross wall, constructed in accordance with commonly accepted building practices (see Figure A3).

The test wall section is to be made of 46 mm ± 1 mm x 95 mm ± 1 mm clean timber sheathed on both sides with 9 mm plasterboard.

Supports as regularly furnished with the flue, are to be installed in accordance with the manufacturer's instructions.

The flue sections are to be placed in the corner of the walls as close as the integral spacers will permit. Where the flue passes through the ceiling, the appropriate ceiling collar shall be fitted.

This test structure is to be erected within a room which is reasonably free of draughts and the flue is to exhaust into the same space or into a space freely communicating with that from which the combustion air is taken.

The room temperature shall not increase by more than 10°C during the complete test.

4 Thermocouples of 24 AWG and with an accuracy of $\pm 2^{\circ}\text{C}$ or better, placed in 8 mm diameter holes drilled in from the back of the plasterboard used for sheathing the wall. The holes shall be flat bottomed and drilled to within 1.6 mm of the plasterboard surface in a grid pattern (see Figure A6). The thermocouples are placed in the holes and bent at right angles to lie as flat as possible on the bottom of the holes. The point at which the wires first make electrical contact to form the junction shall be at least 4 mm from the bend and the thermocouples shall be held in place by an electrically insulating cement.

Additional thermocouples are to be placed in the studs and at other locations if deemed necessary.

5 A thermocouple grid (see Figure A5) located 100 mm above the bottom of the flue shall be used to measure the flue gas temperature. The thermocouple wire shall be 24 AWG or thinner, with an accuracy of $\pm 2^{\circ}\text{C}$ or better.

- 6 Shielded thermocouple to measure room temperature with an accuracy of $\pm 2^{\circ}\text{C}$. The thermocouple shall be located centrally within a 150 mm length of aluminium-painted 50 mm steel pipe, open at both ends.
- 7 Temperature indicator with a switching arrangement and with an accuracy of $\pm 2^{\circ}\text{C}$.

B3.4 PREPARATION OF APPARATUS

- 1 Terminate the vertical test flue at least 2 m above the base. If a test in a two-storey test structure is to be conducted, then a height of 5 m is used with the additional increment encased by a joist and floor area and an enclosure similar to that shown in Figure A3. The additional enclosure is to be placed directly above the one below.

- 2 Attach thermocouples to the surfaces of the flue parts in contact with structural elements.

Where structural elements are adjacent to flue parts, the thermocouples shall have 12 mm of wire exposed and be secured by staples over insulated portions of the wire, the junctions being depressed flush with the surface and held in thermal contact with the surface by paper masking tape or its equivalent.

- 3 Locate the shielded thermocouple on the horizontal plane of the header plate and a horizontal plane 1 m above each additional floor level, mounted on the side wall 400 mm above floor level, 600 mm horizontally from the flue and protruding 15 mm perpendicularly to the side wall (see Figure A3).

NOTE: Direct radiation to the thermocouple should be avoided.

- 4 Connect the flue gas generator outlet to the test flue inlet by means of galvanized flue pipe having a diameter equivalent to that of the flue inlet.

This connection is to be made using a galvanized flue section and fittings (see Figure A4).

The flue and fittings are to be insulated.

B3.5 PROCEDURE

- 1 With the test structure and flue assembly at room temperature, ignite the flue gas generator and set to a gas consumption equivalent to 30% of the flue gas carrying capacity of the flue.
- 2 Adjust the induced air flow (see Figure A2) so that the flue gas temperature is $270^{\circ}\text{C} \begin{smallmatrix} +10^{\circ}\text{C} \\ -0^{\circ}\text{C} \end{smallmatrix}$ above ambient temperature at the test flue entry.
- 3 Check the flue gases for complete combustion in the flue gas generator combustion chamber.
- 4 Measure and record room temperature.
- 5 Measure and record surface temperatures.
- 6 Continue test until temperature equilibrium is obtained.
- 7 Allow to cool, dismantle and inspect the test flue.
- 8 Calculate surface temperature rise by subtracting measured room temperature from actual surface temperature.

B3.6 RESULT

Type 3 twin wall flue meets the requirements of Clause 6.2 if:

- (a) The temperature of adjacent surfaces does not exceed 50°C above ambient.
- (b) The flue assembly does not show any signs of deterioration, in particular:

- (i) No part of the gas flue is damaged or permanently distorted to an extent that it or the assembly will not continue to function as intended.
- (ii) The effectiveness of any required protective coating or finish on metal parts is not impaired.
- (iii) The reflectivity of a surface is not impaired if the reflectivity of such a surface is utilized to reduce fire hazard.
- (iv) The effectiveness of insulating material is not reduced.

B4 M.O.T. 6.3.2 – 88 IMPACT RESISTANCE**B4.1 SCOPE**

This test applies to all exposed flues.

B4.2 METHOD

Three sections of flue are joined and supported and then subjected to impacts from a 9 kg sandbag. The flue is then examined for any separation or damage.

B4.3 APPARATUS

- 1 A swinging impact apparatus (see Figure A7), consisting of a sandbag formed by tightly drawing up all sides and corners of a flat section of canvas around 9 kg of sand, and tying the excess canvas. The rope is to be supported 1.8 m above the centre of gravity of the sandbag.
- 2 Suitable brackets for holding the flue as specified in the manufacturer's installation instructions.

B4.4 PREPARATION OF APPARATUS

- 1 Join three equal lengths of flue following the procedure specified in the manufacturer's instructions.
- 2 Support the flue vertically using the manufacturer's recommended support brackets and procedure.
- 3 Adjust the pivot point of the rope so that the centre of gravity of the sandbag is at the same level as the lower joint in the flue, and the side of the sandbag is within 25 mm of the outer wall of the flue.

B4.5 PROCEDURE

- 1 Move the sandbag out 600 mm from its original position.
- 2 Release the sandbag to allow it to make an impact on the flue pipe.
- 3 Raise the pivot point by a distance equal to half the length of the mid-section of flue.
- 4 Repeat Steps 1 and 2.
- 5 Repeat Steps 1 to 4 so that the impact is at 90° to the original impact.
- 6 Examine the flue for any sign of separation or damage.

B4.6 RESULT

The flue complies with this requirement if there is no evidence of separation or damage.

B4 M.O.T. 6.3.2 – 88 IMPACT RESISTANCE**B4.1 SCOPE**

This test applies to all exposed flues.

B4.2 METHOD

Three sections of flue are joined and supported and then subjected to impacts from a 9 kg sandbag. The flue is then examined for any separation or damage.

B4.3 APPARATUS

- 1 A swinging impact apparatus (see Figure A7), consisting of a sandbag formed by tightly drawing up all sides and corners of a flat section of canvas around 9 kg of sand, and tying the excess canvas. The rope is to be supported 1.8 m above the centre of gravity of the sandbag.
- 2 Suitable brackets for holding the flue as specified in the manufacturer's installation instructions.

B4.4 PREPARATION OF APPARATUS

- 1 Join three equal lengths of flue following the procedure specified in the manufacturer's instructions.
- 2 Support the flue vertically using the manufacturer's recommended support brackets and procedure.
- 3 Adjust the pivot point of the rope so that the centre of gravity of the sandbag is at the same level as the lower joint in the flue, and the side of the sandbag is within 25 mm of the outer wall of the flue.

B4.5 PROCEDURE

- 1 Move the sandbag out 600 mm from its original position.
- 2 Release the sandbag to allow it to make an impact on the flue pipe.
- 3 Raise the pivot point by a distance equal to half the length of the mid-section of flue.
- 4 Repeat Steps 1 and 2.
- 5 Repeat Steps 1 to 4 so that the impact is at 90° to the original impact.
- 6 Examine the flue for any sign of separation or damage.

B4.6 RESULT

The flue complies with this requirement if there is no evidence of separation or damage.

B4 M.O.T. 6.3.2 – 88 IMPACT RESISTANCE**B4.1 SCOPE**

This test applies to all exposed flues.

B4.2 METHOD

Three sections of flue are joined and supported and then subjected to impacts from a 9 kg sandbag. The flue is then examined for any separation or damage.

B4.3 APPARATUS

- 1 A swinging impact apparatus (see Figure A7), consisting of a sandbag formed by tightly drawing up all sides and corners of a flat section of canvas around 9 kg of sand, and tying the excess canvas. The rope is to be supported 1.8 m above the centre of gravity of the sandbag.
- 2 Suitable brackets for holding the flue as specified in the manufacturer's installation instructions.

B4.4 PREPARATION OF APPARATUS

- 1 Join three equal lengths of flue following the procedure specified in the manufacturer's instructions.
- 2 Support the flue vertically using the manufacturer's recommended support brackets and procedure.
- 3 Adjust the pivot point of the rope so that the centre of gravity of the sandbag is at the same level as the lower joint in the flue, and the side of the sandbag is within 25 mm of the outer wall of the flue.

B4.5 PROCEDURE

- 1 Move the sandbag out 600 mm from its original position.
- 2 Release the sandbag to allow it to make an impact on the flue pipe.
- 3 Raise the pivot point by a distance equal to half the length of the mid-section of flue.
- 4 Repeat Steps 1 and 2.
- 5 Repeat Steps 1 to 4 so that the impact is at 90° to the original impact.
- 6 Examine the flue for any sign of separation or damage.

B4.6 RESULT

The flue complies with this requirement if there is no evidence of separation or damage.

B4 M.O.T. 6.3.2 – 88 IMPACT RESISTANCE**B4.1 SCOPE**

This test applies to all exposed flues.

B4.2 METHOD

Three sections of flue are joined and supported and then subjected to impacts from a 9 kg sandbag. The flue is then examined for any separation or damage.

B4.3 APPARATUS

- 1 A swinging impact apparatus (see Figure A7), consisting of a sandbag formed by tightly drawing up all sides and corners of a flat section of canvas around 9 kg of sand, and tying the excess canvas. The rope is to be supported 1.8 m above the centre of gravity of the sandbag.
- 2 Suitable brackets for holding the flue as specified in the manufacturer's installation instructions.

B4.4 PREPARATION OF APPARATUS

- 1 Join three equal lengths of flue following the procedure specified in the manufacturer's instructions.
- 2 Support the flue vertically using the manufacturer's recommended support brackets and procedure.
- 3 Adjust the pivot point of the rope so that the centre of gravity of the sandbag is at the same level as the lower joint in the flue, and the side of the sandbag is within 25 mm of the outer wall of the flue.

B4.5 PROCEDURE

- 1 Move the sandbag out 600 mm from its original position.
- 2 Release the sandbag to allow it to make an impact on the flue pipe.
- 3 Raise the pivot point by a distance equal to half the length of the mid-section of flue.
- 4 Repeat Steps 1 and 2.
- 5 Repeat Steps 1 to 4 so that the impact is at 90° to the original impact.
- 6 Examine the flue for any sign of separation or damage.

B4.6 RESULT

The flue complies with this requirement if there is no evidence of separation or damage.

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