CHIMNEY DEVELOPMENT ASSOCIATION

Chimney Development Association
www.chimneydevelopment.com

MEMBER COMPANIES:

Hepworth Drainage
Hazelhead, Crow Edge,
Sheffield, S36 4HG.
Telephone: 0044 (0)1226 766 699
Fax: 0044 (0)1226 766 934
Email: info@hepworthdrainage.co.uk

Red Bank Manufacturing Company
Atherstone Road, Measham,
Swadlincote, Derbyshire, DE12 7EL.
Telephone: 0044 (0)1530 270 333
Fax: 0044 (0)1530 273 667
Email: sales@redbankmfg.co.uk

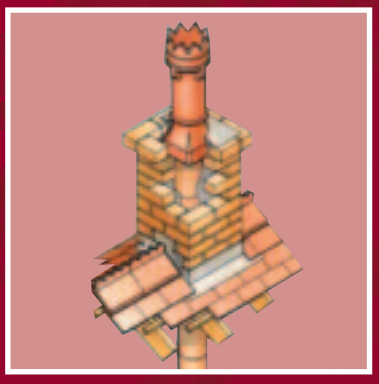
Schiedel Chimney Systems
1 Washingbay Road, Coalisland,
County Tyrone, BT71 4ND.
Telephone: 0044 (0)28 8774 0436
Fax: 0044 (0)28 8774 7430
Email: office@schiedel.co.uk
www.schiedel.co.uk

Schiedel Chimney Systems
Shawell Plant, Gibbet Lane,
Shawell, Lutterworth,
Leicestershire LE17 6AB.
Telephone: 0044 (0)1788 860930
Fax:0044 (0)1788 536151
Email: shawell@schiedel.co.uk
www.schiedel.co.uk

CHIMNEY DEVELOPMENT ASSOCIATION

THE USE OF CLAY FLUE LINERS AND TERMINALS

The high performance, corrosion resistant flue systems



A design and construction guide detailing good practice for using clay flue liners and terminals

January 2005

CHIMNEY DEVELOPMENT ASSOCIATION

This guide shows good practice for the design and construction of flues using clay flue liners and terminals. It is divided into easy to use sections and is illustrated by photographs and diagrams.

INTRODUCTION

General

The function of a chimney flue is to convey the products of combustion safely to the atmosphere. Chimneys lined with clay flue liners have done this and truly stood the test of time. Over four million homes built since the 1940's have chimneys with clay flue liners. Their durability is unquestionable.

They are useable for chimneys serving heating appliances using solid fuel (including wood and peat), gas and oil with a working temperature of 600 °C. They can also withstand a sootfire of 1000 °C.

Acid resistance

The latest heating appliances are far more efficient than their predecessors and their exhaust gas temperature is much lower. This means that the flue gas temperature rarely exceeds the dew point - the point at which any vapour in the products of combustion condenses and turns to liquid.

This condensate is a surprisingly strong acidic solution present on the walls of the flue. Clay flue liners have a proven durability, with an inherent resistance to acid attack, giving no problems with corrosion or disintegration of the liner body. When other flue liner materials are used which have far less resistance to acid attack, such as cement bonded aggregate, the durability and performance of the chimney may be seriously impaired.

Impermeability

Clay flue liners have an impermeable body which does not allow condensates or flue gases to pass through to cause acid attack to the outer fabric of the chimney, which can result in structural deterioration and ugly, permanent staining. They are tested for gas tightness at a differential pressure of 20 Pa and a maximum leakage rate of 0.002 m^3/sec. m^2, after being thermally tested (BS EN 1457 Type A1 N2).

Heat resistance

Soot and condensate deposits, particularly from solid fuels, on the inner wall of the flue liner sometimes re-ignite, causing a "chimney fire". Clay flue liners have a natural resistance to excessive heat and provide an ideal barrier against the spread of a chimney fire into the building. Clay flue liners will withstand a thermal test that simulates sootfire conditions at a temperature of 1000°C for 30 minutes.

CHIMNEY DEVELOPMENT ASSOCIATION

BUILDING REGULATIONS

The basic requirements for the design and construction of chimneys in England and Wales are given in The Approved Document to the Building Regulations 2000 - Part J : 2002 Edition - Combustion appliances and fuel storage systems.

In Scotland, the necessary requirements are laid down in Part F of the Building Standards (Scotland) and several deemed-to-satisfy examples are provided.

In Northern Ireland the requirements are given in Technical Booklet L of the Building Regulations (Northern Ireland) 1990, published by the Department of the Environment for Northern Ireland.

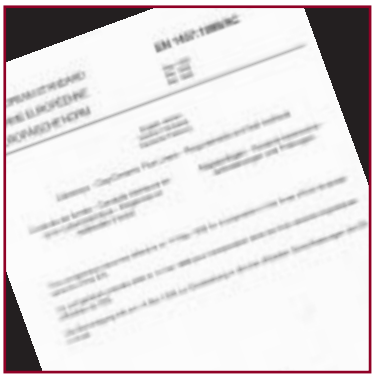
The Building Regulations have key requirements for heat producing appliances and chimneys:

- That there is an adequate supply of air.
- That the products of combustion are safely discharged to the outside air.
- That the building is protected from catching fire.
- That a check list detailing the construction of the chimney should be completed see Annex A.
- That a notice plate detailing the correct application and use of the chimney should be attached within the building see Annex A.

STANDARDS AND CODE OF PRACTICE

Flue liners should be specified to the requirements of the European Standard, BS EN 1457:1999 A1:2002 – Chimneys – Clay/ceramic flue liners – Requirements and test methods. Flue terminals are specified in BS EN 13502:2002 - Clay/ceramic flue terminals – Requirements and test methods. The standards give the relevant details of dimensions and tolerances, performance requirements, sampling procedures, testing and marking.

The construction of chimneys using clay flue liners is detailed in BS 6461: Part 1: 1984 - Installation of chimneys and flues for domestic appliances burning solid fuel (including wood and peat) Part 1 - Code of practice for masonry chimneys & flue pipes.



MARKING

Clay flue liners to BS EN 1457 are marked with the number of the standard EN 1457, the manufacturer's identification, the date of manufacture and their relevant class number e.g. A1 N1.

They also will be stamped with the C.E. if CE certification has been achieved.

Clay terminals to BS EN 13502: 2002 are marked with the number of the standard EN 13502, the manufacturer's identification and the date of manufacture, nominal size, nominal height and type of restricted terminal (if appropriate). They will also be stamped with the CE mark where this has been achieved.

CHIMNEY DEVELOPMENT ASSOCIATION

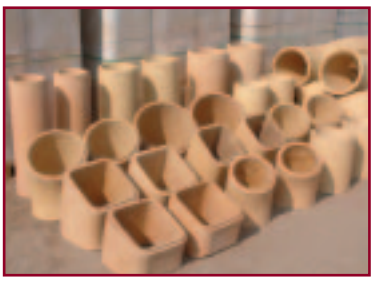
TRANSPORT

Flue liners and terminals are packed and transported with care. Use mechanical off loading when available. Unload with care.

Check their condition and that they are as specified when they arrive on site.

STORAGE

Store flue liners and terminals on a clean, level area, safe from damage. Retain in their delivered packs as far as possible until needed.

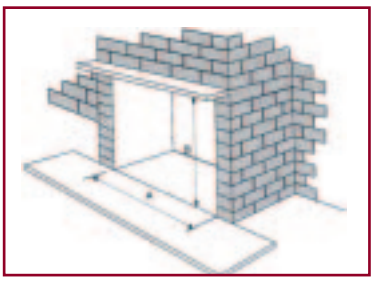


FLUE SIZES

BS 6461 Part 1 recommends a minimum flue size of 200 mm diameter or 185 mm nominal square for a fireplace recess with an opening up to 500 mm x 550 mm, for an open, solid fuel fire. For larger recesses, the flue requires a free opening of 15% of the area of the recess.

The Building Regulations documents specify a range of minimum flue sizes according to the type and rated output of the installed appliance.

It should be noted that low output appliances connected to flues sized for greater outputs will be likely to generate acidic condensates. The use of clay liners for these flues will resist this corrosion.



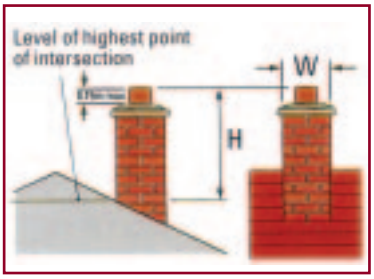
RECESS OPENING

The fire recess is measured as A x B.

HEIGHT

In order to obtain an adequate draw to remove flue gases, a flue should be a minimum of 4.5m high from the top of the fire throat unit to the chimney outlet.

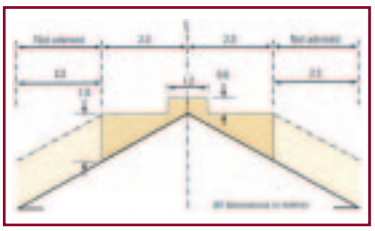
For stability, H should not exceed 4.5 W. H is measured from the level of the highest point of the intersection of the roof and the outer wall of the chimney and a datum level 0.15 m max.. up the terminal. The top of the terminal may be higher than this datum level.



CHIMNEY DEVELOPMENT ASSOCIATION

FLUE OUTLETS

Flue outlets for flues serving solid fuel appliances should be finished above the shaded areas shown in the diagram below so that the flue gases are carried away from the building.



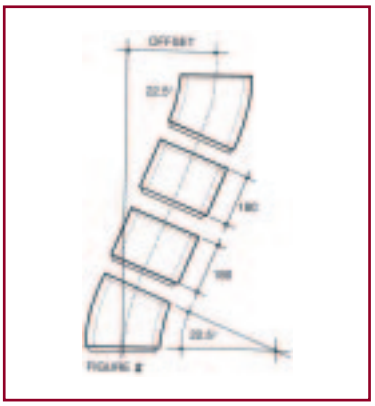
BENDS

Ideally, flues should be straight. The use of offsets is not recommended in the Building Regulations documents but, when needed, they can be achieved by the use of bends, typically 22.5°, 30°, 37.5° and 45°.

Only one offset is allowed for each flue.

The requirements of the Building Regulations documents allow a maximum 45° bend for both gas and solid fuel appliances.

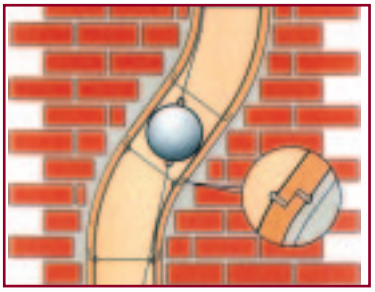
The use of different lengths of straight flue between bends allows flexibility in obtaining an offset to avoid any structural obstacle. Only complete factory made liners should be used for both straight lengths and bends so that the joint rebates remain intact.



INSTALLATION - FLUE LINERS

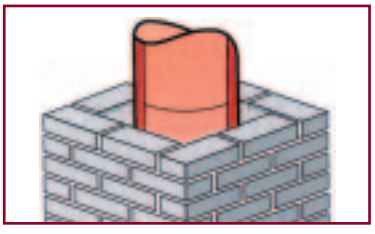
All liners should be laid with the female rebate uppermost. This ensures that condensates formed from the flue gases are not able to flow out from the flue into the surrounding masonry where they would cause structural deterioration and staining of walls as well as providing a path for the possible escape of dangerous flue gases.

The joints between liners must be made with a fireproof mortar or manufacturer's proprietary fireproof sealant.



As work progresses, any mortar ingress into the flueway should be wiped clean. This ensures a smooth passage for the flue gases and for sweeping. It can be achieved by using a coring ball, as shown below. This operation should not be delayed until the chimney is finished as the mortar may have hardened and be difficult to remove.

The space between the outside of the flue liner and the chimney stack should be filled with insulating material such as a weak lime mortar or lightweight insulating concrete.



CHIMNEY DEVELOPMENT ASSOCIATION

INSTALLATION - TERMINALS

The chimney terminal (or "pot") is an important component of a chimney system. It takes the flue gas outlet away from the turbulence created by the bulk of the chimney stack and can reduce the likelihood of water ingress. Also, it can put the flue outlet above the high-pressure zone, which causes down draught problems.

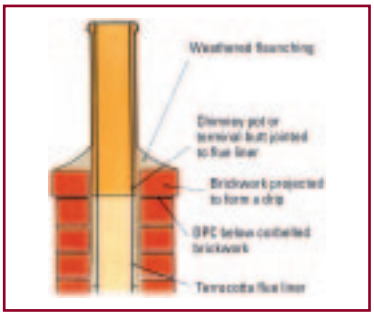
The terminal should be embedded into the top of the stack by 125 mm or one quarter of the height of the terminal, whichever is the greater.

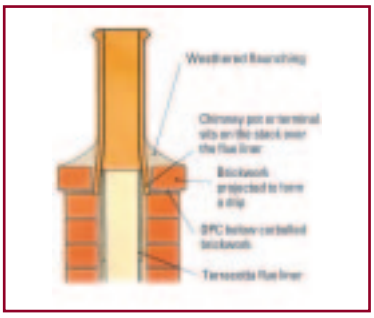
A straight-sided terminal should be butted against the top of the last liner as shown opposite.

A tapered terminal should be fitted over the last liner as shown below. Note that the top of the last liner lies within the corralled brickwork in this case.

A terminal may be formed by extending the flue liner to project above the top of the stack as shown below. It is recommended that at least 150 mm projects above the flaunching.

A flue terminal should always be used to obtain a satisfactory chimney performance. The chimney should not be terminated with just a mortar flaunching.





TERMINALS - RANGE

A wide range of decorative terminals are available from the members of the Association.

TESTING

Check new chimneys for blockage and soundness before use.

Gently lower a coring ball through the flue to determine that it is free from blockage, as for clearing fresh mortar from the bore.

Use a smoke test to check for leakage.

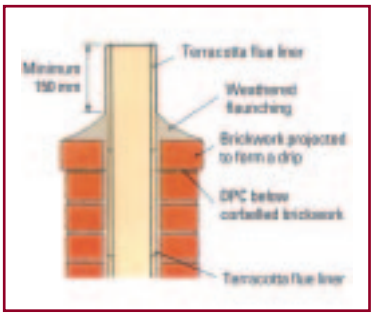
Close up any fitted appliance. Warm the chimney flue for about ten minutes using a blowlamp or similar heating device.

Put two smoke pellets in the appliance firebox (or bottom of the chimney or the appliance recess) and light.

Close the appliance when smoke is formed and allow the smoke to make its way up the chimney. If an open fire is fitted or if the recess is empty, seal the recess using a piece of board sealed at the edges. When smoke is visible from the terminal, seal it, using an inflatable plug or polythene bag.

Remember to remove the seal after the test.

Check for leakage throughout the length of the chimney by examining the chimney breasts and adjacent walls. Leakage may occur at some distance from a fault. Pay particular attention to barge overhangs and eaves to see leakage through wall cavities.



CHIMNEY DEVELOPMENT ASSOCIATION

PERFORMANCE - SITE SITUATIONS

Leaking flue gases and condensates show up clearly as ugly, permanent stains on chimney walls that can be the indicators of structural deterioration. Clay flues safely contain all combustion products causing no harm to the structure.

The acidic nature of flue gases is clearly illustrated by the picture of concrete tiles, which have been severely corroded below a chimney, compared with the replacement concrete tile to the left of the picture. Clay tiles, used above that area, are unaffected.

The acid resistance tests provided in the BS EN 1457 for clay flue liners and BS EN 13502 for terminals, provide assurance of the products' long term performance in service.

PERFORMANCE - DURABILITY

The increasing use of high efficiency appliances, which give rise to the condensing of flue gases within the flue, give specifiers and installers cause to consider the corrosive effect that the resultant acid condensates can have on certain flue materials.

BS EN 1457 and BS EN 13502 provide an accelerated acid resistance test to represent a corrosion resistance and practical installed life of at least 100 years, it simulates the effects of an acid condensate on clay flue liners. The performance requirement for class A1N2 liners and terminals is that the loss in mass of a test sample should not exceed 5%.

Certain concrete flue liners suffer a mass loss in excess of 10% when subjected to the same test.

In the simple visual comparison test illustrated below, after immersing clay and concrete flue liners in an acidic solution of similar strength to the condensate from a typical modern appliance (pH approximately 3) for less than a week, the concrete demonstrates clear signs of deterioration whilst the clay is unscathed.

Further detailed design guidance is available in the Code of practice BS 6461: 1984: Part 1 and the relevant parts of the National Building Regulations documents, as listed earlier.

REMEMBER –

Clay flue liners and terminals are:

- Heat resistant
- Acid resistant
- Suitable for all domestic fuels
- Proven in use for over 50 years (much more for terminals!)
- Made to the European Standard

CHIMNEY DEVELOPMENT ASSOCIATION

ANNEX A

NOTICE PLATE AND CHECKLIST

FOR INSTALLATION OF CLAY FLUE PRODUCTS

The new 2002 Edition of Approved Document J (ADJ) of the Building Regulations for England and Wales came into force on the 1st April 2002 and specifies the following requirements:

- All combustion, flue and chimney installations are to be checked during construction and on completion as specified in the ADJ paragraphs 1.53 to 1.55 using the inspection and smoke test procedures in Appendix E of the ADJ.
- A Checklist is to be completed recording that the "materials and components appropriate to the intended application have been used and that flues have passed the appropriate tests".
- A permanent Notice Plate is fixed at an appropriate position giving details on the location of the hearth, fireplace, or beginning of the flue; the type and size of flue and the types of heating appliance that can be used. This is a mandatory requirement under the new Building Regulation J4 for England and Wales. Similar requirements for provision of a Notice Plate apply in Scotland as detailed in paragraph F3.12 of the Building Standards (Scotland) Regulations.

Responsibility for complying with the requirements of the ADJ rests with the person carrying out the installation work, such as the house builder, developer, sub-contractor or specialist firm.

Checking Installations during Construction

As specified in Approved Document J, all installations must be checked during construction. The following guidelines are based upon the requirements and procedures given in the ADJ Appendix E:

- Check that appropriate flue liner components to suit the intended appliance are installed correctly in accordance with the product installation instructions. Ensure that components are complete, as damaged items must not be used.
- Make sure the flue liners are installed with the rebate uppermost and the joints are fully sealed with fireproof mortar (ADJ paragraph 1.28). Manufactures' Fireproof Mortar is available in tubes or tubs.
- The gap between flue linings and surrounding masonry should be at least 25mm (ideally 35mm) and filled with weak semi-dry insulating concrete comprising one part of ordinary Portland cement to 20 parts of expanded clay aggregate mixed with a small amount of water (ADJ paragraph 1.28). Manufactures' Insulating Backfill is available in approx. 20 kg bags.
- Ensure that the flueway is kept clear of any obstructions, debris or excess jointing material extruding from the flue liner/flue block joints.
- Check that the flueway is acceptably gas-tight by carrying out a smoke test.

Manufactures' Smoke Pellets are available in tubes containing 6 No. Pellets

Note: Smoke Test and Inspection procedures are given in Appendix E of the ADJ and the relevant British Standards. Gas Flue Block installations should be smoke tested when they reach each floor level and on completion of the flue. Flue Liner installations should be smoke tested on completion of the chimney.

Checking Installations on Completion

As specified in paragraphs 1.53 to 1.55 in the ADJ all installations must be checked upon completion. The following guidelines are based upon the procedures given in the ADJ Appendix E:

- Carry out a visual inspection to ensure flueway is clear of obstructions and that the appropriate materials and components of a suitable size for the intended appliance have been installed.
- Where necessary undertake checks to demonstrate that the flue is free from obstruction, if a visual check is not sufficient it may be appropriate to sweep the flue or carry out a coring ball test as described in sections E9 and E10 of Appendix E.
- Check the operation and gas tightness of the flue by carrying out a smoke test, as shown on the enclosed guidelines and in accordance with testing procedures as described in sections E13 to E16 of Appendix E.

Checklist

As required in paragraph 1.53 of the ADJ a report should be drawn up to confirm that the correct materials have been used and the flues have passed the appropriate tests and the report should be provided to the client, developer or main contractor 'Who may be asked for documentation by the building control body".

A sample check list is shown in Document J. Check lists are also available from the manufacturers.

It is recommended that a copy of the completed Checklist be kept by the installer as evidence of the actions taken to comply with the requirements of the ADJ.

CHIMNEY DEVELOPMENT ASSOCIATION

NOTICE PLATE

The new requirement J4 of the Building Regulations states "Where a hearth, fireplace, flue or chimney is provided or extended, a durable notice containing information on the performance capabilities of the hearth, fireplace, flue or chimney shall be affixed in a suitable place in the building for the purpose of enabling combustion appliances to be safely installed". Details are given in paragraphs 1.56 to 1.58 of the ADJ.

A notice plate can be purchased from the manufacturers.

Once the Notice Plate is completed using indelible ink it must be securely fixed in an unobtrusive but obvious position within the building such as by the electricity consumer unit, water supply stop-cock or gas meter within the building or by the chimney / hearth described.

FURTHER INFORMATION

The new ADJ is published under the title the Building Regulations 2000 Approved Document J Combustion Appliances and Fuel Storage Systems 2002 Edition (ISBN no. 0 11 753494 3) and can be purchased from the Stationery Bookshops or via their website at www.tso.co.uk. The ADJ can also be viewed on the ODPM website at http://www.safety.odpm.gov.uk/bregs/brpub/ad/ad

CHIMNEY DEVELOPMENT ASSOCIATION

EXAMPLE OF HOW TO COMPLETE THE CHECKLIST FOR CHECKING AND TESTING OF HEARTHS, FIREPLACES, FLUES AND CHIMNEYS

This checklist can help you to ensure hearths, fireplaces, flues and chimneys are satisfactory. If you have been directly engaged, copies should also be offered to the client and to the Building Control Body to show what you have done to comply with the requirements of Part J. If you are a sub-contractor, a copy should be offered to the main contractor.

1. **Building address, where work has been carried out** .....

.....

.....

2.	**Identification of hearth, fireplace, chimney or flue.**	*Example: Fireplace in lounge*	*Example: Gas fire in rear addition bedroom*	*Example: Small boiler room*
3.	**Firing capability: solid fuel/gas/oil/all.**	*All*	*Gas only*	*Oil only*
4.	**Intended type of appliance. State type or make. If open fire give finished fireplace opening dimensions.**	*Open fire 480 W x 560 H (mm)*	*Radiant/convector fire 6kW input*	*Oil fired boiler 18kW output (pressure jet)*
5.	**Ventilation provisions for the appliance: State type and area of permanently open air vents.**	*2 through wall ventilators each 10,000mm² (100cm²)*	*Not fitted*	*Vents to outside: Top 9,900mm² Bottom 19,800mm²*
6.	**Chimney or flue construction**			
a)	**State the type or make and whether new or existing.**	*New. Brick with clay liners*	*Existing masonry*	*S.S. prefab to BS4543-2*
b)	**Internal flue size (and equivalent height, where calculated - natural draught gas appliances only).**	*200mm Ø*	*125mm Ø (H_{eq}3.3m)*	*127mm Ø*
c)	**If clay or concrete flue liners used confirm they are correctly jointed with socket end uppermost and state jointing materials used.**	*Sockets uppermost Jointed by fire cement*	*Not applicable*	*Not applicable*
d)	**If an existing chimney has been refurbished with a new liner, type or make of liner fitted.**	*Not applicable to BS 715*	*Flexible metal liner*	*Not applicable*
e)	**Details of flue outlet terminal and diagram reference.**			
	Outlet Detail:	*Smith Ltd Louvred pot 200mm Ø*	*125mm Ø GCI terminal*	*Maker's recommended terminal*
	Complies with:	*As Diagram 2.2 AD J*	*As BS 5440-1: 2000 Figure C.1*	*As Diagram 4.2 AD J*
f)	**Number and angle of bends.**	*2 x 45°*	*2 x 45°*	*1 x 90° Tee*
g)	**provision for cleaning and recommended frequency.**	*Sweep annually via fireplace opening*	*Annual service by CORGI engineer*	*Sweep annually via base of Tee and via appliance*
7.	**Hearth. Form of construction. New or existing?**	*New. Tiles on concrete floor. 125mm thick. As Diagram 2.9 AD J*	*Existing hearth for solid fuel fire, with fender.*	*New. Solid floor Min 125mm concrete above DPM. As Diagram 4.3 AD J*
8	**Inspection and testing after completion**	*Inspected and tested by J Smith, Smith Building Co*	*Tested by J Smith, CORGI Reg no. 12345*	*Tested by J Smith, The Oil Heating Co.*
	Tests carried out by:			
	Tests (Appx E in AD J 2002 ed) and results			
Flue inspection	**visual**	*Not possible, bends*	*Not possible, bends*	*Checked to Section 10, BS7566:Part 3: 1992 – OK*
	sweeping	*OK*	*Not applicable*	
	coring ball	*OK*	*Not applicable*	
	smoke	*OK*	*Not applicable*	*OK*
	Appliance (where included) spillage	*Not included*	*OK*	*OK*

I/We the undersigned confirm that the above details are correct. In my opinion, these works comply with the relevant requirements in Part J of Schedule 1 to the Building Regulations.

Print name and title .....Profession .....

Capacity ... (e.g. "Proprietor of Smith's Flues", Authorising Engineer for Brown plc) .....Tel no .....

Address .....Postcode.....

Signed .....Date .....

Registered membership of ... (e.g. CORGI, OFTEC, HETAS, NACE, NACS) .....

CHIMNEY DEVELOPMENT ASSOCIATION

EXAMPLE OF HOW TO COMPLETE THE NOTICE PLATES FOR HEARTHS, FIREPLACES AND FLUES

Essential information

IMPORTANT SAFETY INFORMATION

This label must not be removed or covered

Property address	*20 Main Street, New Town*
The hearth and chimney installed in the	*lounge*
are suitable for	*decorative fuel effect gas fire*
Chimney liner	*double skin stainless steel flexible, 200mm diameter*
Suitable for condensing appliance	*no*
Installed on	*date*

Optional additional information

Other information (optional) .....

e.g. installer's name, product trade names, installation and maintenance advice, European chimney product designations, warnings on performance limitations of imitation elements e.g. false hearths.

EXAMPLE

EXAMPLE OF NOTICE PLATE