Flue & Chimney Systems

BS EN ISO 9002:1994
Certificate No. FM 34121

HAMWORTHY
flue products

System Solutions

Prefabricated Stainless Steel Flues & Chimneys

With a multitude of flue systems and components available in the commercial flue market today, it is all too easy to become confused about which solution to choose.

At Hamworthy we prefer to keep things a little simpler by offering you straightforward support and advice, to achieve the appropriate solution for your particular application.

We may simplify solutions, however, this is only possible due to our extensive knowledge and experience with products of combustion, fuel burning appliances and their applications.

Hamworthy have been manufacturing combustion equipment and commercial heating appliances for over thirty years, and have used this experience for more than ten years to design and manufacture innovative commercial flue systems.

Hamworthy Heating are active members of the British Flue & Chimney Manufacturers Association, (BFCMA), contributing to technical and safety issues for the development of the flue industry in this country.

It is this experience, combined with our high levels of customer service, that enables us to provide cost effective flue solutions for reliable and efficient system performance.

BENEFITS

- **Appliance & flue system harmonised**
- **Choice in scope of supply**
- **Wide range of appliance experience**
- **Extensive application experience**
- **Full portfolio of flue system products**
- **Confidence in system solution**

Our experience of optimising flue solutions extends to Hamworthy equipment and appliances from other manufacturers

We manufacture flue systems for a wide range of commercial applications including:

- **Boilers**
- **Water Heaters**
- **Space Heaters**
- **Condensing boilers**
- **Single or multiple appliances**
- **Gas fired, Oil fired, Dual Fuel and Solid Fuel**
- **Atmospheric, Pre-Mix, Pressure Jet Equipment**

- Standard flue components and ancillaries
- Packaged fan dilution systems
- Bespoke flue components
- Bespoke flue systems
- Plant room ventilation systems
- Design and installation services

OPTIONS

Choice of Solutions

We recognise that the scope of supply for a project is dependent on many variable factors, therefore, we offer a range of products and services, which can be tailored to satisfy our customers particular project requirements.

We are able to offer a wide range of components as supply only, and for the more complicated projects we manufacture bespoke and specialist components.

Our design and installation capability offers solutions for bespoke flue and chimney systems, and can include the design and installation of plant room combustion air and ventilation systems.

Our flue systems include natural draught, fan assisted and fan dilution solutions.

Component Supply

We are able to design and install flue solutions to achieve optimum performance, however, it may be that you already have the design complete.

In these circumstances we are more than happy to supply the components against your bill of materials to enable the installation to be completed by others.

Our standard range of component sizes is from 127mm to 660mm diameter, but smaller or larger sizes are available on request.

Flues are manufactured in three main formats: single wall, twin wall with air gap and twin wall insulated.

Twin wall components are manufactured with a 25mm annular gap as standard, and options are available for 50mm or 75mm gap.

Components are manufactured in 304 bright annealed stainless steel, with 430 or 316 stainless steel available, along with other materials, depending on application.

All components are manufactured to the highest standard, and quality is assured through our BSI accreditation to BS EN ISO 9002.

Windshield flue

Bespoke Components

Using our experience in multiple boiler installations, we manufacture a range of specialist components to suit the individual designs of particular applications. These include:

- Non-standard headers
- Cross tees
- Transformation pieces
- Square and rectangular ducting
- Variable modular tees
- Appliance header tees

Ancillary items

In addition to our manufactured components and equipment we also provide ancillary items to complete flue installations. These include:

- Flexible flue liners
- Clamp plates
- Flow switches
- Differential pressure switches
- Draft stabilisers
- Dampers

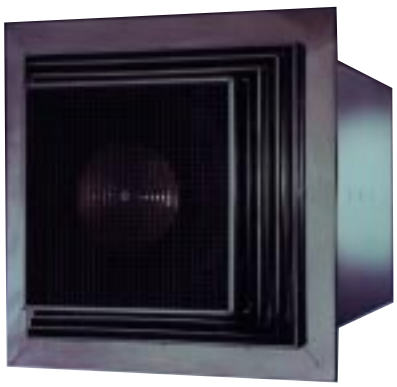
Fan Dilution

Hamworthy Heating's reputation for product innovation is no better illustrated than in the design of fan dilution equipment.

Hamworthy recognised the benefits to be gained from improving on conventional fan dilution components.

The development of Hamworthy's Forston packaged fan dilution systems offers customers greater choice in achieving flue system solutions.

The scope for using fan dilution applications increases greatly when considering the benefits of a packaged system.



Conventional fan dilution systems were perhaps previously limited to overcoming technical or architectural arguments.

Providing packaged fan dilution systems is simpler for the customer, saves space and reduces the installation costs.

Hamworthy also offers conventional fan dilution systems for applications where packaged systems are not practical.

Air Supply & Ventilation

In addition to removing products of combustion through our flue systems, we will also design and install systems for air supply and ventilation of plant rooms.

This is particularly relevant where naturally ventilated systems are not practical and fan systems need to be applied, interlocked with appliance control systems.

This includes provision of high and low level ventilation requirements for basement plant rooms and ducted air supply direct to appliances.

Design & Installation

For those customers who would rather not have to consider all the variables of efficient flue system design, we offer a complete design and installation service.

Design

Using information supplied for the project, we will make an initial assessment and propose a solution based on technical and commercial considerations.

Our field based sales engineers are able to offer first hand support in the office or on-site to ensure the full extent of the project is correctly interpreted.

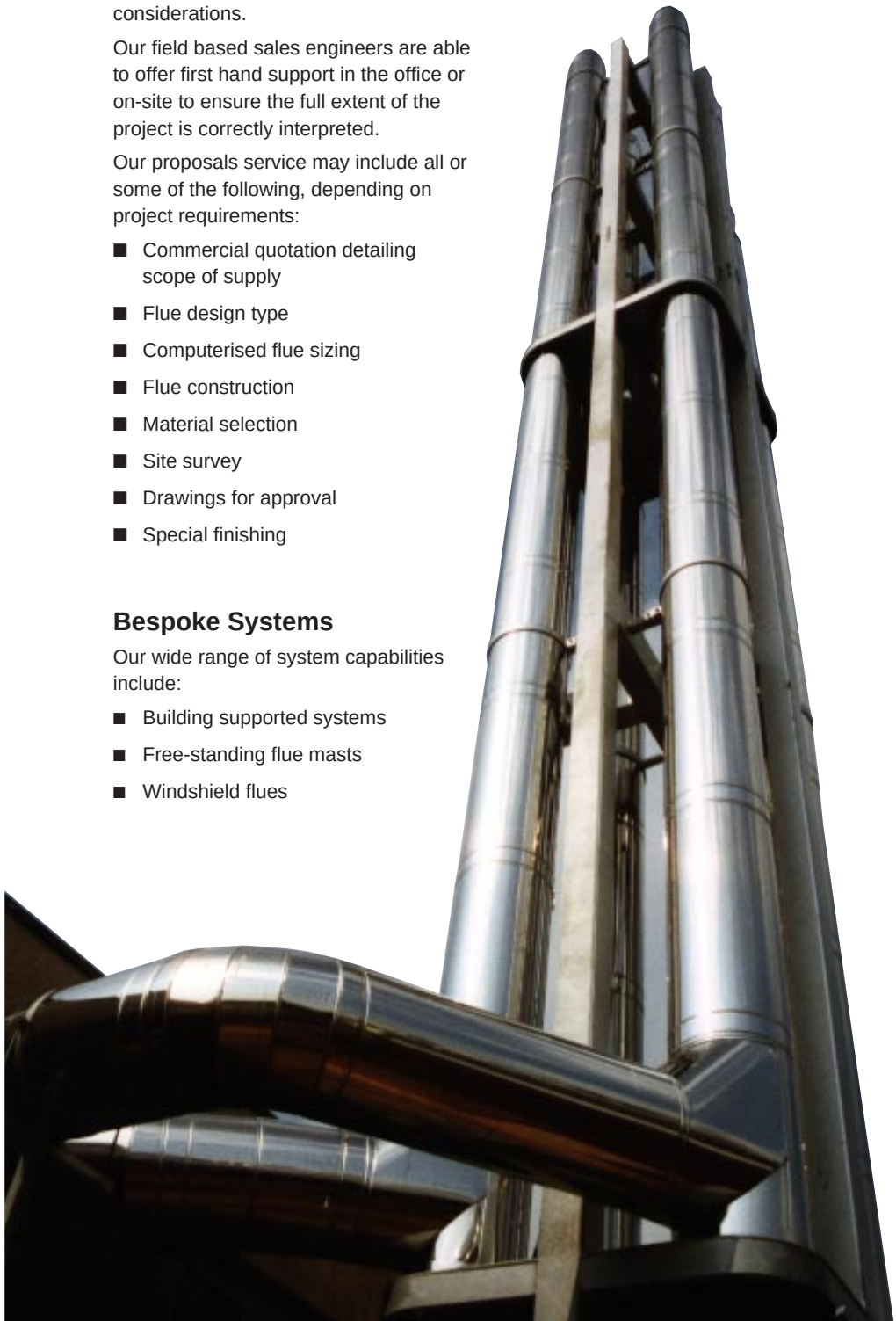
Our proposals service may include all or some of the following, depending on project requirements:

- Commercial quotation detailing scope of supply
- Flue design type
- Computerised flue sizing
- Flue construction
- Material selection
- Site survey
- Drawings for approval
- Special finishing

Bespoke Systems

Our wide range of system capabilities include:

- Building supported systems
- Free-standing flue masts
- Windshield flues



Installation

The quality of any flue system is only as good as its installation and at Hamworthy we pride ourselves on the performance of our installation teams.

Our site surveys are undertaken after the appliance has been positioned. This enables us to identify any last minute problems, particularly associated with routing and potential obstructions.

As part of our quality assurance BS EN ISO 9002 contract review procedures, our contract management teams carefully monitor and control each project, to ensure that they run to schedule and provide a smooth transition on site.

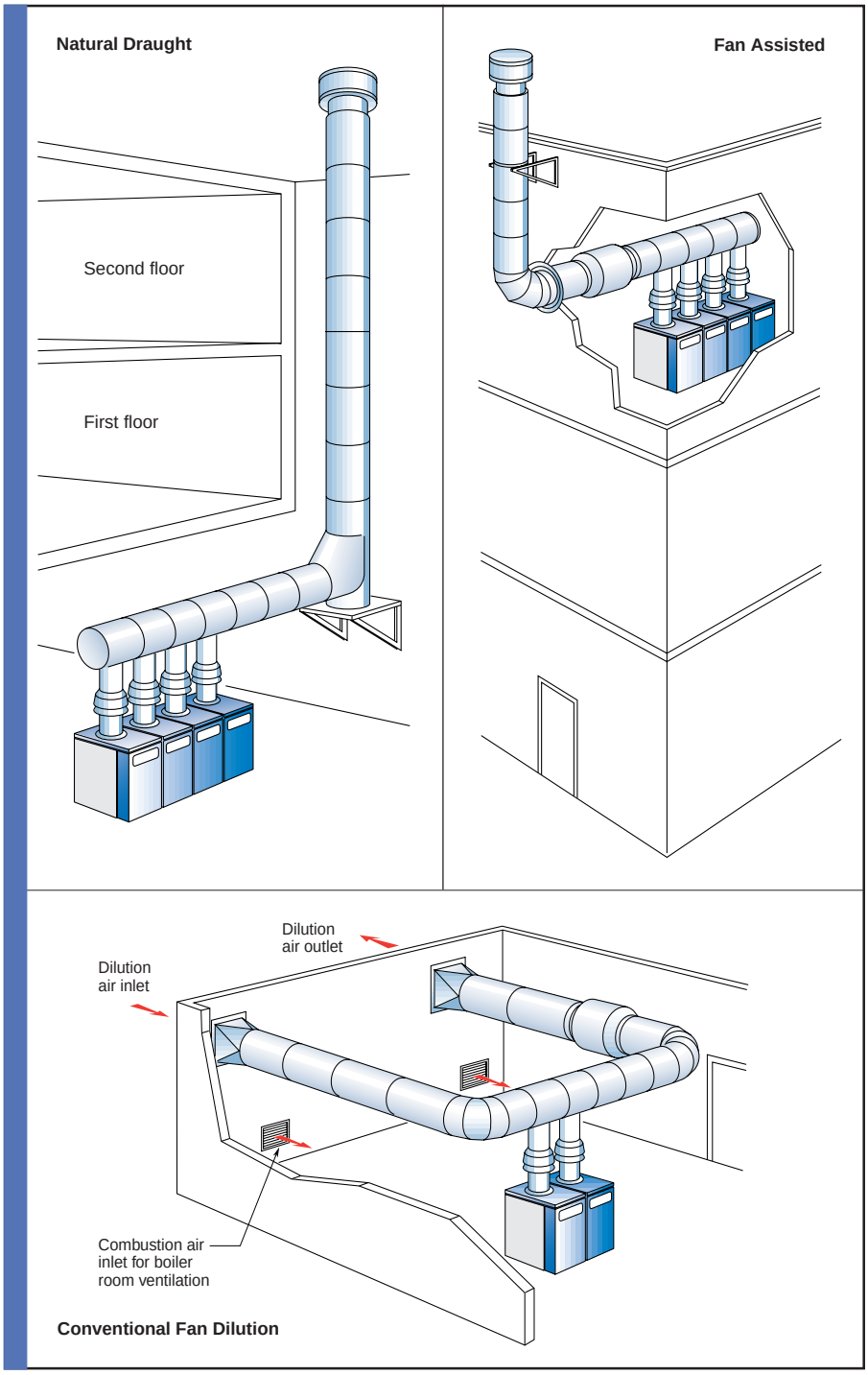
Depending on the type of flue system specified, the scope of supply may include commissioning, although in most cases, this would be part of the main appliance commissioning requirement.

Aspects of Flue & Chimney Design

Any fuel burning appliance requires a means of safely conveying the products of combustion to atmosphere.

The flue gases, containing NOx and CO, must be discharged safely, complying with the requirements of the Building Regulations, Clean Air Act, Fire Regulations, British Standards and various Codes of Practice along the way.

Problems associated with flues can be avoided if the flue system and its appliances are properly designed, installed and maintained.



Natural draught flue systems are the most common solution, relying on the laws of physics to exhaust the waste products of combustion to atmosphere.

Fan assisted flue solutions are fundamentally designed to overcome system resistance where flue size and height are apparent limiting factors.

The fan diluted flue solution is specific to those applications where a conventional flue system is not practical on technical or architectural grounds.

The adoption of fan dilution is ideal for situations such as ground floor shop premises, where because of flats or offices above, it would be difficult to install a conventional flue.

Factors to Consider in Flue and Chimney Design

- Appliance rating
- Appliance outlet size
- Positive or negative system pressure
- CO_2 emission levels
- Number of appliances per chimney
- Required efflux velocity
- Ambient air temperature
- Ambient atmospheric pressure
- Routing, horizontal sections, bends etc.
- Vertical chimney height
- Flue resistance
- Internal and external routing, (% of total).
- Prevailing wind direction
- Termination
- Material expansion
- Legislative requirements

Specifying the Solution

Clearly, with all these factors, and others beside, to consider, it's no wonder that some systems simply do not perform to expectation.

That's why we at Hamworthy Heating take the trouble to consider these factors, and offer you the optimum solution for your flue system requirements.

Physics of Flues

Hot gases will flow from the appliance through to the chimney and rise upwards to atmosphere at the top.

The gases are less dense than the surrounding air and rise up the chimney to produce a draught.

The temperature of the gases leaving the appliance, the volume of flue gas and the design of the chimney terminal, are some of the factors which influence the velocity and hence the force of the draught.

The higher the flue gas temperature, the greater the rise, natural draught and influence on the flue gas velocity. Conversely, the lower the temperature the greater the need to select appropriate solutions.

If the total output of the appliances served by the chimney exceeds the capacity of the chimney, problems will occur when the appliance(s) operate at maximum output.

In the case of atmospheric appliances, this will result in spillage of flue gases into the room at the appliance draught diverter.

If a flue system is too small it will not provide the necessary suction at the appliance flue outlet.

On forced air appliances it will have an adverse affect on the performance of the appliance.

To overcome this, either the height of the chimney or its diameter must be increased.

Chimney Performance

The performance of any chimney is governed by a number of factors.

The height of the chimney, its cross sectional area, the routing of the flue from appliance to chimney, the terminal and the material of construction.

Chimneys that are too high can effect the system in two ways.

Firstly, the oversizing may cause the flue gases to cool too much, thereby weakening the draught.

Secondly, the additional height may increase the draught to a level which causes problems with the appliance combustion process, exhausting the gases too quickly.

In applications where the flue suction at the appliance exceeds the manufacturers specification, then a draught stabiliser may be required in the flue system.

Prefabricated Chimneys

Traditional brick chimneys have a high thermal mass and a low thermal inertia.

The heat from the flue gases is absorbed by the brickwork as the gases rise. This has a cooling effect which reduces the draught.

Insulated prefabricated steel chimneys, however, have a low thermal mass and create a higher thermal inertia.

By retaining the heat within the chimney, the flue gases stay hot and discharge safely to atmosphere.

Part Load Design

Where a single chimney is used to flue the products of combustion from a multiple appliance installation, it should be remembered that all of the appliances firing together only occurs for a relatively small percentage of time.

For the remainder, as the flue gas volume decreases, so does the velocity and this makes the system more susceptible to downdraught, which can lead to spillage.

Condensation in Flues

If a flue is oversized, whilst it may function correctly most of the time, it may lead to increased condensation. This is because of the extra heat loss due to the increased surface area of the flue.

In addition, the lower velocity means that there is a longer residence time in the flue itself, again resulting in increased levels of condensation.

The condensate can cause damage to the chimney and appliance if drainage is not addressed correctly.

The potential for corrosion by condensate will vary, depending on the fuel being burned in the appliance.

When designing a flue system, sufficient consideration must be given to the drainage of the condensate that may form.

The design should ensure that condensate can be safely drained to a suitable waste point, and that the flue and drain pipework material is resistant to the corrosive effects of the condensate.

Flue Gas Temperatures

In many cases, the chimney is designed to keep flue gases as hot as possible, to generate sufficient draught.

The construction of the flue and selection of insulation material also serves to reduce the risk of damage to the building.

Building Regulations require that there should be a minimum air gap clearance of 50mm between the chimney and any combustible materials.

Additionally, firestops, spacers and ceiling supports must be used where the chimney passes through floors and ceilings.

Low Level Discharge

The increase in room sealed appliances and balanced flues can create problems with discharging flue gases in ground floor installations, where the outlet may be just a few feet above ground level.

This can be a particular problem with commercial appliances, which tend to have higher outputs and therefore more products of combustion to discharge safely.

Fan Dilution Systems

Fan dilution flues are a widely used method of flueing small to medium commercial systems (up to a maximum of 6MW heat input) where it is difficult to install a natural draught flue.

The principle is to mix the products of combustion with fresh air drawn from the outside atmosphere, to reduce the CO_2 to less than 1% and so permit the flue discharge to be located at low level.

A conventional fan dilution installation would have appliances connected by vertical flue sections to a header, which is open to the outside air at both ends. A fan is located on the discharge side of the header duct, drawing air in across the appliance flues and mixing the air with products of combustion to discharge to atmosphere.

Hamworthy's packaged fan dilution systems achieve the mixing within the unit, saving space, reducing the flue run and speeding up the installation.

Material Selection

The selection of materials will be dependent on a number of factors, one of which is the fuel used to fire the appliance, as this affects the flue gas temperatures.

Gas fired

430 grade stainless steel is satisfactory for most installations where the temperature of the products of combustion is unlikely to exceed 250°C.

304 grade stainless steel should be used for flue gas temperatures above 250°C and where corrosive atmospheres are likely to be encountered, such as in coastal areas.

See section below for additional factors to consider with condensing boilers.

Oil fired

304 grade stainless steel should be used for appliances firing on gas, oil or kerosene, because of the acidic nature of the products of combustion.

Condensing boilers

The products of combustion from condensing boilers will be below their dew point.

The low flue gas temperature will be insufficient to generate enough buoyancy for the gases to be evacuated naturally, thus, at some point in the system they will be mechanically assisted.

The resulting pressure, coupled with the moisture in the gases, demands that the flue system be gas and water tight.

The corrosive nature of the product of combustion demands that a good quality stainless steel, such as 316 grade or high purity aluminium, SICH4 grade, be used to transport the gases to atmosphere.

Air Supply & Ventilation

An adequate supply of fresh air for combustion and ventilation must be provided in the plant room.

The air supply should be free from contamination such as building dust and insulation fibres from lagging.

This is particularly important in forced draught applications to avoid unnecessary cleaning and servicing of the burner.

Hamworthy recommend that boilers are not fired whilst building and lagging work is being undertaken.

Room Ventilated

Commercial heating equipment has traditionally been installed in room ventilated applications.

Gas Fired

For gas fired boilers total rated input over 60kW, the air supply and ventilation should be in accordance with BS 6644.

The air supply should be achieved by using one of the following methods:

- Natural ventilation supplying air with a low level opening and discharging through a smaller sized high level opening.
- A purpose designed balance compartment using high level permanent openings adjacent to the flue outlet.
- A fan to supply air to a low level opening with a natural discharge through a high level opening.
- A fan to supply air to a low level opening and discharged by means of a fan at high level.

Fans must be selected so that a negative pressure is not created in the boiler house, relative to outside air pressure.

The air supplied for boiler house ventilation should be such that the maximum temperatures within the boiler house are as follows:

- At floor level: 25°C
  (or 100mm above the floor level)
- At mid level: 32°C
  (1.5m above the floor level)
- At ceiling level: 40°C
  (or 100mm below ceiling level)

Further allowances for ventilation should be made in applications where appliances are likely to be running at or near maximum capacity during the summer season.

Where natural ventilation is used, suitable permanent openings at low level and high level connected directly to the outside air should be provided.

These openings must be fitted with grilles that cannot be blocked or flooded.

The free area of the grilles should be as follows:

Low Level (Inlet)
540cm^2 plus 4.5cm^2 per kW in excess of 60kW total rated input.

High Level (Outlet)
270cm^2 plus 2.25cm^2 per kW in excess of 60kW total rated input.

Oil Fired

For oil fired boilers of 44kW and above, the air supply and ventilation should be in accordance with BS 5410 part 2.

Where natural ventilation is used, there should be permanent low level and high level openings connected directly to the outside air.

Low Level (Inlet)
a free area of not less than 0.2m^2 for each 300kW of installed boiler capacity.

High Level (Outlet)
a free area of not less than 0.1m^2 for each 300kW of installed boiler capacity, minimum 12000mm^2 , for general ventilation.

Balanced compartment

By using a balanced flue terminal it is possible to create a balanced compartment as an alternative solution.

In effect, this allows incoming combustion and ventilation air to be supplied through the same terminal as the flue discharge. It has the added advantage of removing the need for louvre panels for ventilation in the plant room.

With the air intake and flue discharge in the same pressure area, the risk of downdraught is eliminated.

The balanced compartment facilitates the installation of appliances in a part of the building where ventilation would otherwise be difficult, such as in internal rooms, where there is no outside wall to meet the high and low level ventilation requirements.

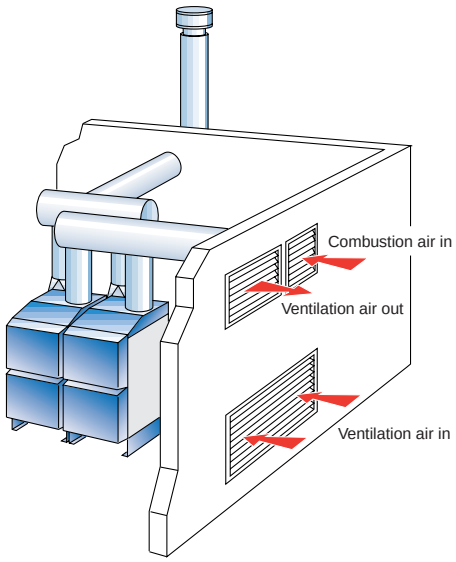
Ducted air supply

Although not classified as room sealed, there are now appliances on the market which facilitate ducting of incoming combustion air.

This enables clean air to be introduced to the appliance, which is particularly important where the normal ambient air supply may contain dust, or other airborne contaminants which may be corrosive, such as in laundries and process environments.

By ducting in the air supply, the performance of the appliance can be improved, and in some circumstances, corrosion of the appliance reduced, prolonging the life of the appliance.

Ducted air to boilers



Room Sealed

Many commercial appliances are now available as room sealed. This opens up new possibilities for equipment locations within the building.

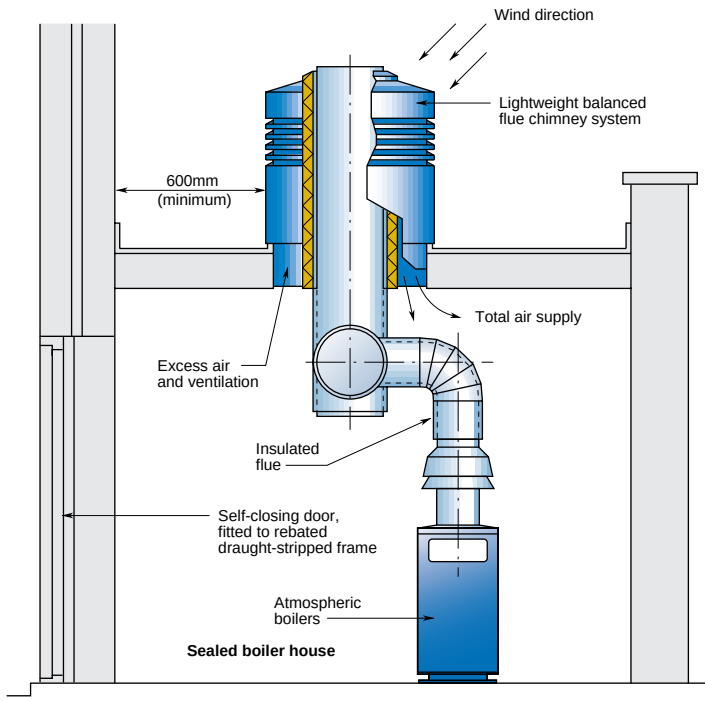
There are different requirements regarding the positioning of the flue discharge, because the incoming combustion air supply and the flue gas discharge are in the same pressure area.

For these applications, the flue must be airtight and watertight at the seams and joints.

Combustion air can be supplied through a concentric air duct and flue system from outside the building.

For room sealed appliances up to 60kW rated input, the supply of ventilation air should be in accordance with BS 5440 part 2.

Balanced compartment



Flue Guidance Notes for Condensing Boilers

Flue gas temperatures can be very low when the boiler is condensing, but it should be remembered that even when it is not condensing, the temperature of the flue gas would be lower than that of a conventional boiler.

The flue gas volume is reduced and the buoyancy is also reduced such that nearly all condensing boilers are fitted with a fan to provide the necessary energy to exhaust the products of combustion.

There are times when a condensing boiler is operating just above the flue gas dew point so that the condensing takes place in the flue duct rather than the boiler. Apart from the boiler not being able to benefit from this release of energy, the condensation produced has to be drained appropriately. This would equate, in theory, to 1.5 litres of water per hour for a 100kW-rated appliance.

The following points should be considered when planning a flue for a condensing boiler.

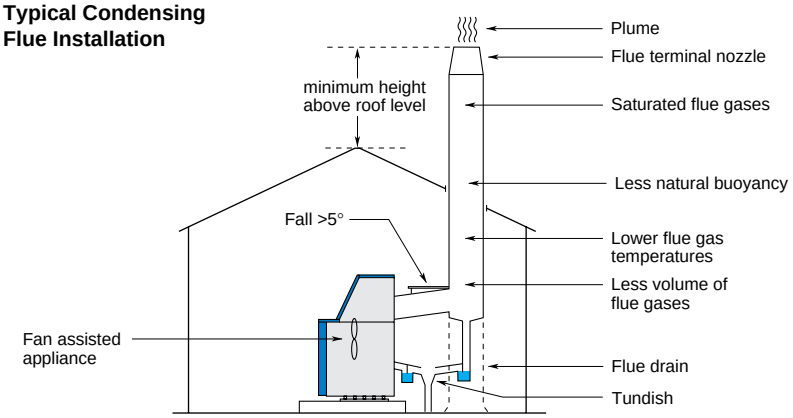
There should be no horizontal sections in the flue where condensate could lie.

In any socket/spigot flue pipe design the sockets should be facing upwards.

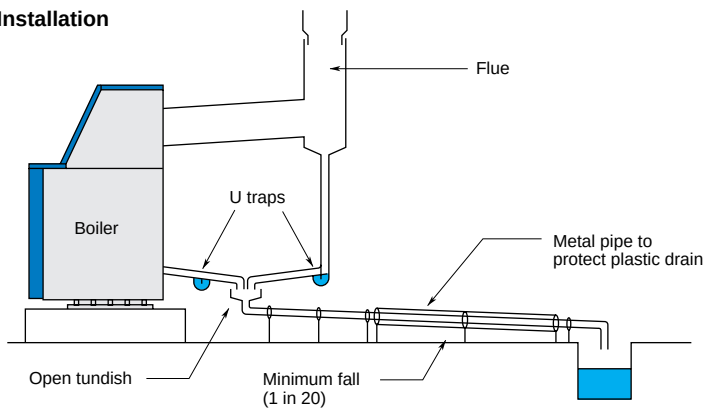
The bore of the flue should be smooth, free of any convolutions or corrugations, which would provide localised condensate traps where the acid content could be increased by evaporation.

A condensate drain should be provided at the lowest part of the flue and where it is not possible to drain all the flue at the one position extra condensate drains should be provided.

Typical Condensing Flue Installation



Typical Condensate Drain Installation



There should be a water trap in each separate condensate drain line to prevent the escape of flue gases where there is a positive pressure in the flue, or the ingress of air, if on the suction side of a fan.

This trap should be sited in an area where it will not freeze under winter conditions to restrict the free flow of flue gas condensate. The UK winter climate can be very variable with the possibility of sub-zero temperatures being followed very quickly, with little time for thawing, by milder weather and boiler plant operating in condensing mode.

The condensate drain should be impervious to dilute acid attacks. In particular copper or brass should not be used.

Where more than one condensing boiler or a mixture of condensing and non-condensing boilers are to be connected to the same flue, care should be taken over the size and layout of the ductwork and the extremes of ambient and operating temperature must be considered to avoid spillage from shutdown boilers.

Terminals accentuate the formation of plumes which are to be expected from condensing flues, however, provided the flue has been designed for good drainage, a flue terminal is not essential. Nevertheless it may be necessary to fit a wire screen to prevent the ingress of debris.

The flue should be constructed from acid resisting stainless steel or aluminium.

Flue dilution systems are ideally suited to the flueing of combined condensing and non-condensing appliances. The very high excess air levels of some 10 times that of a traditional flue, reduces the flue gas dew point to almost that of air, thus reducing the level of condensation in the duct to little more than a traditional non-condensing installation.

Fan Dilution Guidance Notes

For Gas Fired Applications

When using atmospheric boilers, due to the natural buoyancy in the flue along with the low resistance of the draught diverter, there will be a tendency to draw dilution air through the diverters and hence from the boiler house. Provision of very low resistance ductwork and careful sizing of dampers are essential to avoid the need for extra ventilation.

At the design flow conditions the resistance of the air duct and louvres should equal the suction requirements of the boiler where boiler and air ducts meet.

To avoid excess noise the exit velocity should be kept to a minimum, although the requirement of the Clean Air Act equates to 7.5m/s for natural gas, to encourage air entrainment.

Dampers should be fitted to control the dilution air and balance the system.

An air flow switch must be installed which will shut down the heating equipment in the event of a failure or blockage.

Ideally, the inlet and outlet louvres of the duct should be positioned on the same wall to provide a balancing effect against wind pressure. Alternatively, a side wall intake with a vertical discharge may be provided.

The position of the flue outlet must be chosen so that the diluted products do not accumulate in the vicinity of the terminal. Sheltered positions should be avoided and louvres should divert the products away from other air inlet systems and prevent ingress of rain.

The location of outlets should be in accordance with BS 6644 and comply with the manufacturer's recommendations for the appliance. Minimum distances to other fan assisted inlets, operable windows and nearest buildings should be observed. Local authority approval for the outlet position should be obtained.

Where cooling air for the motor is also used as dilution and is taken from the boiler house, extra ventilation must be provided, but to comply with BS 6644 the air should be ducted to the motor.

Refer also to:

- British Gas Publication IM/11.
- 'Flues for Commercial and Industrial Gas Fired Boilers and Air Heaters'
- BS 5440 Codes of practice for gas appliances up to 60kW.
- Part 1 - Flues
- Part 2 - Air Supply
- BS 6644 Installation of Gas Fired Hot Water Boilers rated outputs 60kW to 2MW.
- Clean Air Act Memorandum.

Packaged Fan Dilution Systems

Traditionally, fan dilution systems have always routed large dilution ductwork down to the boiler and then back to the outside wall.

This traditional method consumes more energy, generates higher noise levels and takes up valuable plant room space.

Careful consideration has gone into the Hamworthy Forston design to eliminate such problems.

The Forston range of packaged fan dilution systems offer pre-assembled units that require less flue ductwork, reducing associated noise levels and minimising the amount of energy used.

Forston 200
The Forston 200 can be used on a single flue system serving multiple appliances with a combined output up to 200kW, or is equally suited to serving individual larger appliances up to 200kW.

For further details refer to publication 500002183.

Forston 400
The higher capacity Forston 400 offers versatility in installation through a choice of vertical or horizontal mounting.

Forston 400

Installed vertically, the Forston 400 requires less wall space than a typical doorway and the construction allows the use of standard lintels in a wall opening.

In the horizontal position, the design enables two lintels to be used, rather than a single larger heavier beam. The discharge louvres can be repositioned through 90 degrees for horizontal discharge.

The Forston 400 can be used on a single flue system serving multiple appliances, handling a combined output up to 400kW.

It is also well suited to serving individual larger appliances up to 400kW.

For further details refer to publication 500002095.

Individual Systems
The Forston packaged fan dilution systems are suitable for individual appliance applications up to the units maximum rated output.

This provides a flexible option in terms of system maintenance, whereby individual fan dilution systems and appliances can be shut down without losing complete heating or hot water output.

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