

# CHAPTER 9: Building Services

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# FUNCTIONAL REQUIREMENT

## 9.1 Drainage (below ground)

### Workmanship

- i. All workmanship must be within defined tolerances as defined in Chapter 1 of this Manual.
- ii. All work to be carried out by a technically competent person in a workmanlike manner.

### Materials

- i. All materials should be stored correctly in a manner which will not cause damage or deterioration of the product.
- ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
- iii. The structure shall, unless specifically agreed otherwise with the warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability but not in any circumstances less than 15 years.

### Design

- i. Design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
- ii. The materials, design and construction must meet the relevant Building Regulations and other statutory requirements, British Standards and Euro-Codes.

### introduction

This chapter provides direction on achieving the technical requirements for internal services.

### general

Internal services shall be designed, constructed and installed so that they:

- Conform to all relevant statutory requirements.
- Do not adversely affect the structural stability of the Housing Unit.
- Prevent the entry of hazardous ground substances, external moisture or vermin.
- Are constructed using non-hazardous materials.
- Are durable and robust.
- Are safe and convenient in use.

### 9.1.1 Drainage (general)

A trapped gully should be provided where impervious surfaces such as drives, paths and hard-standings drain to a rainwater drainage system. Impervious surfaces can drain to a permeable area within the garden, providing it is free draining.

The drainage system, including manholes, gullies, pipe connections, etc, should be protected from damage throughout the course of the construction works.

### 9.1.2 Pipework

Where ground movement is likely to occur flexible drainage systems should be provided, e.g. filled sites, mining areas and sites with shrinkable clay. Where possible, avoid passing adjacent to tree roots. Adequate precautions should be taken where this cannot be avoided in accordance with the recommendations of the relevant Building Control Body and the Pipe Manufacturer.

Drainage trench excavations should be taken down to solid ground but when this is not possible, the drainage system should be designed to accommodate any movement and made up with a well compacted backfill to the required formation levels.

The depths of drains and the protection provided over needs to be adapted to the traffic normal for the location, in accordance with the recommendations of the relevant Building Control

Body and the Pipe Manufacturer:

- i. Pipes should be laid to an even gradient and significant changes in gradient should be combined with an access point.
- ii. Pipes should be laid in straight lines but may be laid to slight curves providing the length of drain can be effectively cleaned by the use of rods.
- iii. Connections should be to inspection chambers or manholes, but connections to junctions are acceptable if access is provided to clear blockages. In all cases discharge should be in the direction of flow.
- iv. Bends should be positioned in or adjacent to terminal fittings, inspection chambers or manholes and at the foot of discharge stacks. Bends should have as large a radius as practicable.
- v. The system should be ventilated at or near the head of each main drain to allow free passage of air throughout, the maximum length of any branch serving a single appliance being 6m and for a group of appliances 12m.
- vi. Where appliances are not fitted with integral traps at the point of discharge a trap must be provided using either a trapped gully or low back trap.

### 9.1.3 Drainage materials

Drain materials should comply with either

- BS 1194 – Concrete porous pipes
- BS 65 or BS 1196 – Clayware pipes
- BS 4962 – Plastic pipes

Land drains are to be laid to a uniform gradient with falls of not less than 1:200 and as recommended by the Pipe Manufacturer.

### 9.1.4 General backfill

In normal circumstances, the excavated material from the trench will be appropriate for backfilling above the chosen material. General backfill materials must be free from:

- i. Boulders
- ii. Building rubble
- iii. Timber
- iv. Vegetable matter

Backfill needs to be positioned in layers not deeper than 300mm, and needs to be well compacted. When compacted backfill is at least 450mm above the crown of the pipe, mechanical compacting should only be used.

### 9.1.5 Drain protection adjacent to foundations

Drains are to be located so that foundation loads are not transmitted to pipes. Where drainage trenches are located near to foundations, foundation depths should be increased or the drain re-routed further from the foundations.

The trench should be filled with concrete to an appropriate level where the bottom of a trench is below foundation level.

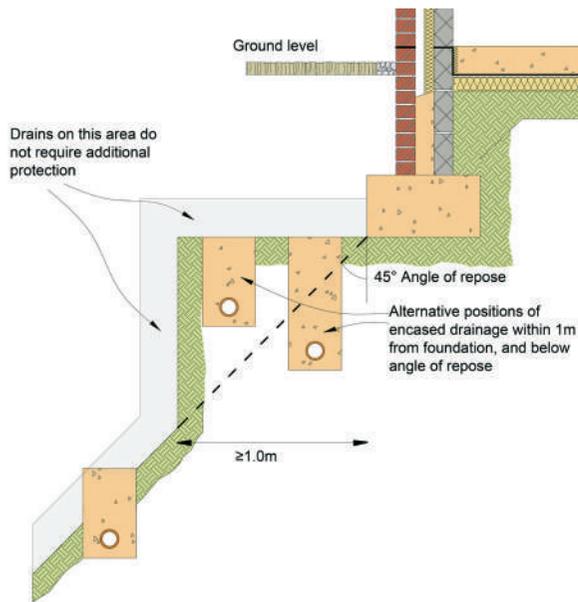


Figure 1: Drainage positions situated within angle of repose and adjacent to foundation by 1m

Walls should accommodate movement where drains pass through substructure by:

- 50mm clearance all round
- A sleeve with a 50mm clearance
- If built in, a connection on both sides of the wall to pipes with flexible joints located not more than 150mm from the face of the wall

### 9.1.6 Combined drainage system

A system that carries both foul and storm water from a property will usually be found on older

properties where a local authority combined sewage system is the only discharge point.

It may be required to install surface and foul water drains independently, even where a site is being assisted by an existing combined sewer. This needs to be confirmed by the relevant authorities prior to design of the drainage.

It is vital that all surface water fittings have an integral trap so that foul gases do not cause problems when a one pipe system is installed.

A combined drain should be capable of accepting peak surface and foul water flows (BS EN752). It is also good design practice to guarantee that self-cleansing velocity (0.75 l/s) is reached when only foul water is entering the drain.

### 9.1.7 Foul water drainage system

Foul water drainage systems only take foul waste from a property or properties. Foul waste is the waste water from sinks, toilets, showers, baths, dishwashers and washing machines. These systems discharge into local authority sewers, then pass through sewage treatment plants. By separating the foul waste and taking it straight through to treatment plants, you are not treating large volumes of storm water needlessly.

### 9.1.8 Surface water

Surface water drainage is allowable by the use of one of the following systems:

- An adequate soak away or some other adequate infiltration system; or where this is not realistic;
- A watercourse; or where this is not realistic;
- A sewer.

This helps to minimise surface water arriving into the foul water drainage system. This can often overload the capacity of the sewer and cause flooding.

### 9.1.9 Provision of gutters and downpipes

If the roof area is greater than 6m<sup>2</sup> it needs to be provided with rainwater gutters and downpipes. Thought should also be given to the provision of rainwater drainage to roof areas less than 6m<sup>2</sup> such as dormer roofs.

Discharge of gutters into downpipes can be substantially improved by careful location of downpipes such as:

- Locating downpipes at end quarter positions will double the flow capacity if more than one downpipe is required.
- The downpipe should be located within 200mm of the change in direction in order to maintain the flow capacity of the gutter where changes in the line of the gutter occur.

Type of surface area	effective design area
Paved areas	Plan area
Flat roof plan	Area of roof
30° roof pitch plan	Area x 1.29
45° roof pitch plan	Area x 1.5
60° roof pitch plan	Area x 1.87
70° roof pitch plan	Area x 0.5

Table 1: Calculation of roof area

Max effective roof area (m <sup>2</sup> )	gutter size (mm dia)	r WP outlet size (mm dia)	Flow capacity (litres/sec)
6			
18	75	50	0.38
37	100	63	0.78
53	115	63	1.11
65	125	75	1.37
103	150	89	2.16

Table 2: gutter sizes and outlet sizes

### 9.1.10 layout of land drains

Drain runs on sloping sites need to be positioned perpendicular to the fall of the site.

Land drains should be positioned adjacent to paths, drives and outbuildings. The pipe soffit should be positioned at least 400mm below the finished ground level and the backfill consolidated to the same degree of compaction as the adjacent soil.

### 9.1.11 Soakaways

Soakaways are a simple way of dispersing surface and storm water, in circumstances where connection to the SW system is not feasible or unnecessary. A soakaway is basically a system that loses water rather than collects water. Soakaways are a part of the SuDS (Sustainable Urban Drainage Systems) technologies that handle storm water at the source rather than leading it into the public sewer systems.

Soakaways can only be considered in permeable conditions. A suitable site must:

- Be in a location lower than the area being drained.
- Be at least 5m away from any building (BS 8301).
- Be situated so that it will not saturate the foundations of any structure.
- Be situated so that the base of any soakaway/infiltration system is permanently above the water table.
- Be situated far enough away from other soakaway/infiltration systems to ensure that the capacity of those other systems and the ground itself is not impaired.
- Be situated so that there is no risk of contamination from pollutants.

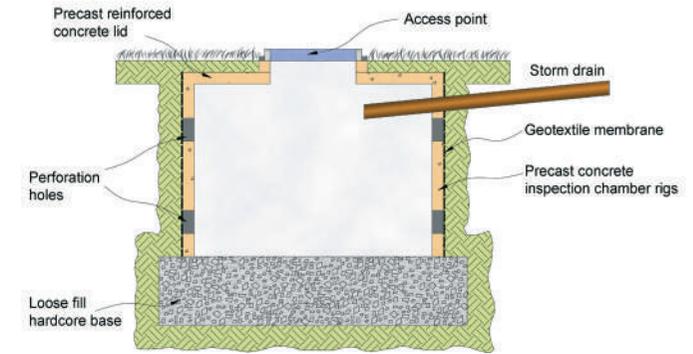


Figure 2: Chamber type soakaway

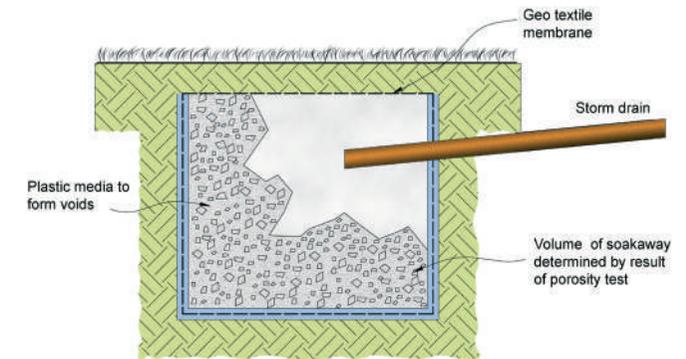


Figure 3: Typical soakaway design

**9.1.12 Septic tank systems / treatment plants / cesspits**

If you are not on main line drainage then you will have a septic tank, treatment plant or cesspit of some description, ordinarily the foul waste will run to one of the above tanks while the rain water is usually kept separate to help the bacteria and enzyme in the tank perform their function. The out fall from the septic tank would either run to a soakway or possibly straight to a river or brook. You will often find the rainwater system tapped onto the outlet of a septic tank to help dilute down any effluent that may pass through the system.

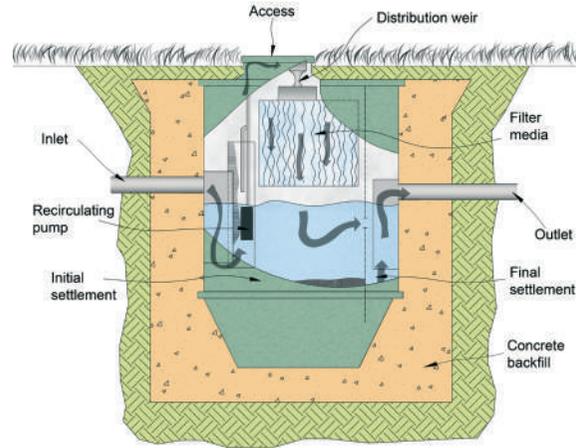


Figure 5: Typical sewage treatment plant

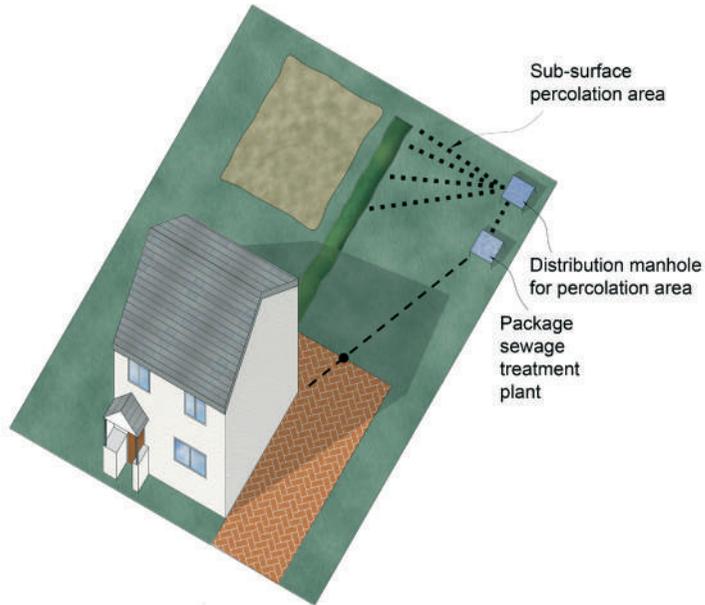


Figure 4: Typical package sewerage plant

# FUNCTIONAL REQUIREMENT

## 9.2 Drainage (above ground)

### Workmanship

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### Materials

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- ii. All materials, products and building systems shall be appropriate and suitable for their intended purpose.
- iii. The structure shall, unless specifically agreed otherwise with the warranty provider, have a life of not less than 60 years. Individual components and assemblies, not integral to the structure, may have a lesser durability but not in any circumstances less than 15 years.

### Design

- i. Design and specifications shall provide a clear indication of the design intent and demonstrate a satisfactory level of performance.
- ii. The materials, design and construction must meet the relevant Building Regulations and other statutory requirements, British Standards and Euro-Codes.

### 9.2.1 above ground drainage

All above ground plumbing systems need to be designed to allow the unobstructed flow of waste water from an appliance to the underground drainage system. To achieve this, the points below should be noted at the design and installation stages:

- i. Provide rodding access facilities at all changes of direction.
- ii. Avoid bends and changes of direction in the wet part of the of the above ground drainage system.
- iii. 75mm deep seal traps should always be used except on a WC or where an appliance on the ground floor discharges directly into a trapped gully.
- iv. Pipe sizes should not exceed the dimensions for diameter against pipe length.
- v. Pipe should be laid at gradient 1/80 or better.
- vi. Any admittance valve fitted to the system should be located above the highest flood level of any appliance connected to that stack pipe.
- vii. Enclosures to air admittance valves should be adequately ventilated.
- viii. The highest point of a drainage system (head of run) should always be vented to the external air.

### 9.2.2 Soil and waste systems

The unobstructed flow of waste in all above ground plumbing systems will be allowed from an appliance to the underground drainage. This will be achieved by following the notes below at design and installation stages:

- i. Rodding access is to be provided at all direction changes.
- ii. Pipe and gutter sizes are adequate to take the expected rate of discharge and are laid at suitable gradients with the minimum of direction changes.
- iii. 75mm deep seal traps should always be used except on a WC OR where an appliance on the above ground drainage system.
- iv. Pipe sizes should not exceed the dimensions for diameter against pipe length.
- v. Pipe sizes should be laid at a gradient of 1/80 or better.
- vi. Venting to the external wall at the highest point of a drainage system (head of run).
- vii. At the head of underground drains ventilation is to be provided, either by a soil pipe, or a separate ventilation pipe.
- viii. A soil or ventilation pipe should extend at least 900mm above an opening if it is less than 3m away from an opening into the building.
- ix. The drains are adequately protected from ground loads.

### 9.2.3 air admittance valves

Air admittance valves provide a means of ventilation to the drainage system to prevent the loss of water seals in traps.

They are suitable for use in domestic buildings, e.g. bungalows, houses, multi-storey flats and they only allow air to enter the drainage system. Their use does not avoid the need to adequately ventilate the drainage system.

Where air admittance valves are used to terminate soil pipes they should comply with BS. Valves within the building should be

- Positioned in areas which are not liable to freezing.
- Positioned in areas which have adequate ventilation.
- Accessible for maintenance.

If the discharge stack provides the only ventilation to septic tanks or cesspools, the connecting drain is subject to periodic surcharging or is fitted with intercepting traps, air admittance valves are not suitable ventilation.

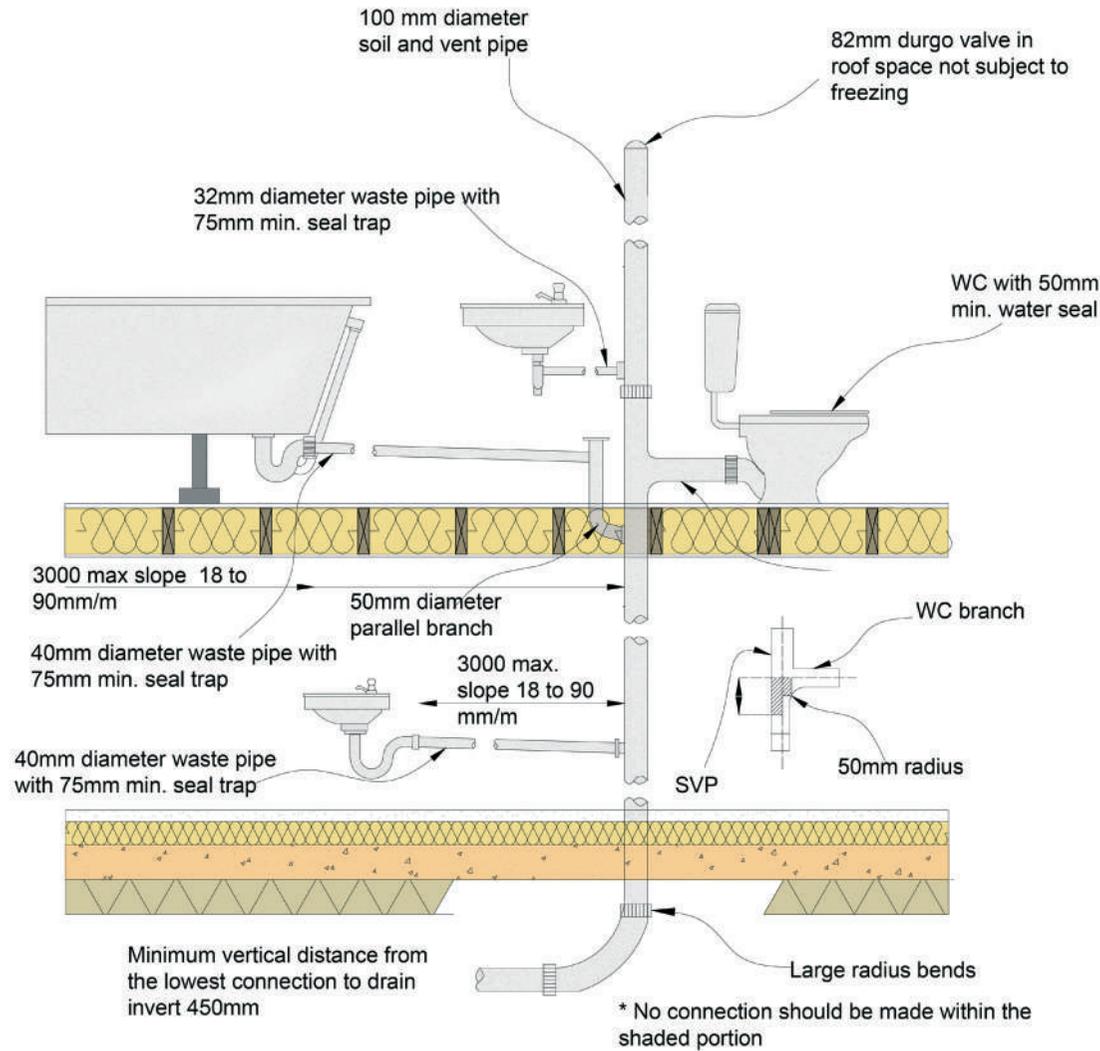


Figure 6: Single stack system - air admittance valves

### 9.2.4 Provision of information

Design drawings for internal services will need to include:

- Location of sanitary fittings.
- Drainage runs.
- Location and size of cold water storage cisterns.
- Location and size of hot water storage cylinder.
- Hot and cold water pipe runs.
- Gas supply pipe runs.
- Electrical outlets, switches and consumer unit.

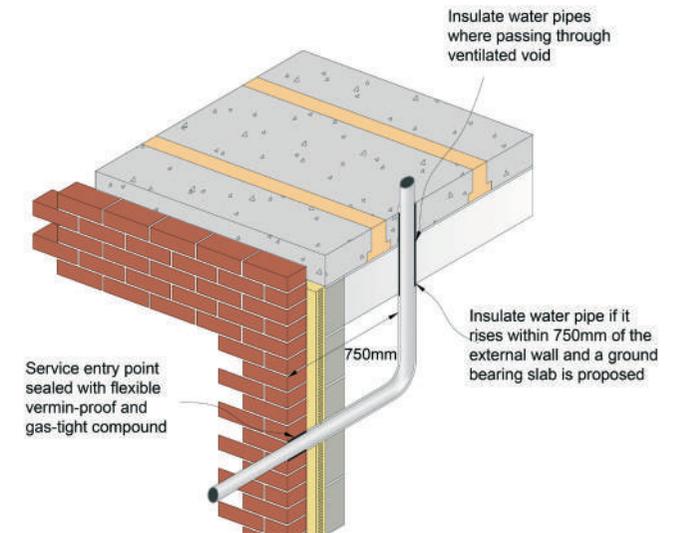


Figure 7: Sealing of service entry points

# FUNCTIONAL REQUIREMENT

## 9.3 eleCTriCal inST alla TionS

### Workmanship

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- ii. All work to be carried out by a technically competent person in a workmanlike manner.
- iii. Certification is required for any work completed by an approved installer.

### Materials

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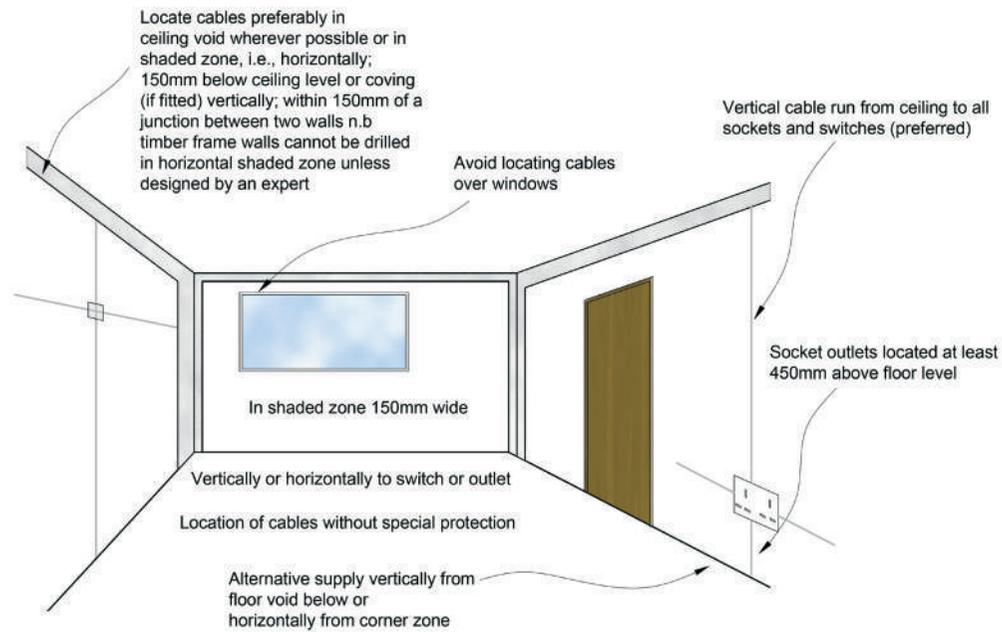
### Design

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- ii. The materials, design and installation must meet the relevant Building Regulations and other statutory requirements. British Standards and Euro-Codes.

**general**

A suitable electrical service shall be provided of the appropriate size for normal domestic use.  
 PVC covered cables should not be in contact with polystyrene insulation.

Electrical cables should not be diagonal and their locations should be in accordance with Figure 8.



**Figure 8: location of cables without special protection**

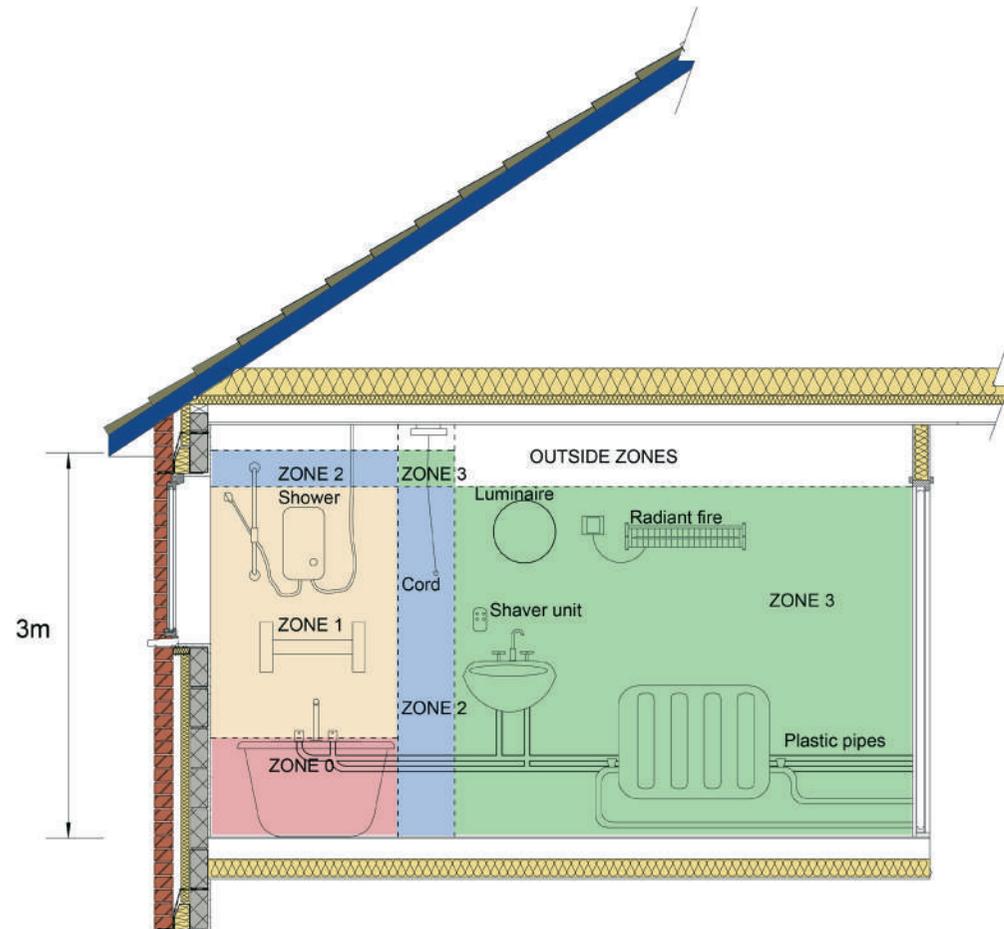
### Supplementary earth bonding

For domestic situations supplementary bonding is required in areas of increased risk. These are rooms containing a bath or shower. It is not required within kitchens, utility rooms or wash rooms.

Supplementary bonding is not required to the pipes or the metal fittings attached where plastic pipes are used within a bathroom or shower room.

This also applies where short lengths of metal pipes connected to bathroom fittings are attached to plastic pipes.

Supplementary bonding is still required to electrical equipment such as an electric shower or electric heater. This type of bonding is also required to be connected to the protective conductor of all circuits supplying electrical equipment in the bathroom.

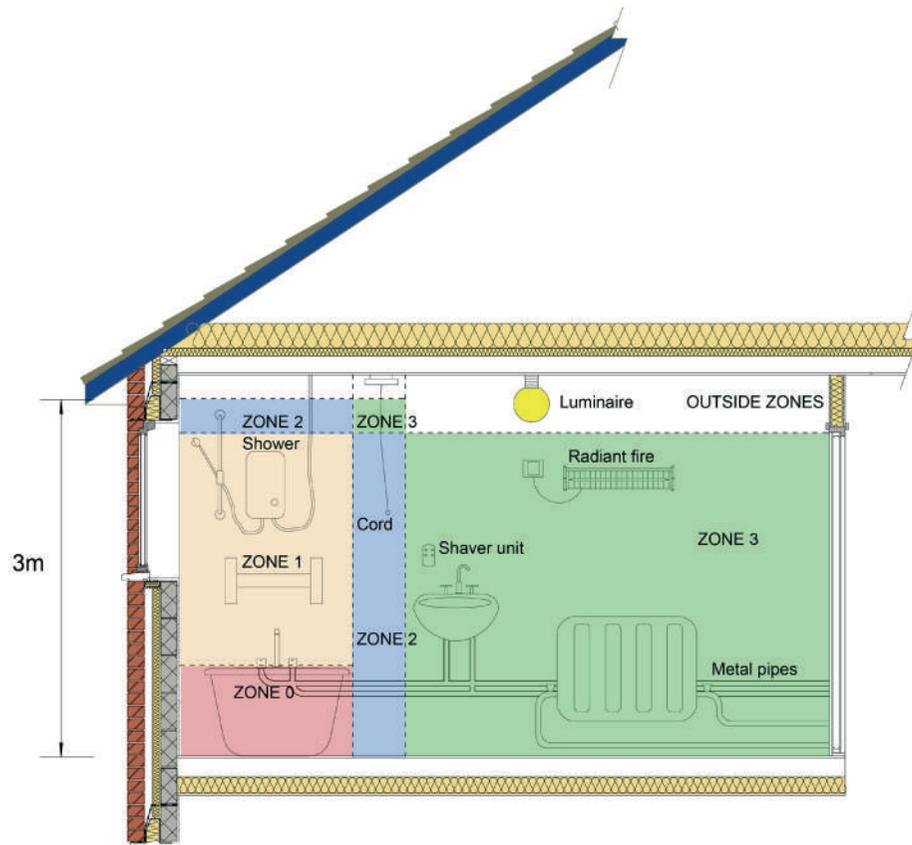


The protective conductors of all power and lighting points within the zones must be supplementary bonded. The bonding connection may be to earth terminal of a switch or accessory supplying equipment

Circuit protective conductors may be used as supplementary bonding conductors.

Supplementary bonding of short lengths of copper pipe installed where the pipes are visible, is not necessary

Figure 9: Supplementary bonding in a bathroom, plastic pipe installation



The protective conductors of all power and metal lighting points within the zones must be supplementary bonded to all extraneous conductive parts in the zones including metal waste, water and central heating pipes, metal baths and shower basins.

Circuit protective conductors may be used as supplementary bonding conductors.

Metal baths not connected to a metal building structure do not require supplementary bonding if all metal pipes connected to them have been bonded.

Connection to pipes to be made with BS 951 clamps (complete with "Safety Electrical Connection" label)

Figure 10: Supplementary bonding in bathroom, metal pipes

### Socket outlets

Socket outlets are to be conveniently positioned in close proximity to the TV aerial and telephone outlets allowing for electrical equipment such as TVs and DVD players. Rooms should be provided with the following 13a outlets.

- Kitchen / Utility - eight outlets
- Dining room – four outlets
- Living or Family room – eight outlets
- Bedroom (main) – six outlets
- Bedroom (other) – four outlets
- Landing – two outlets
- Hall – two outlets

### Cooking

Cooking appliances which are suitably switched and terminated with a minimum 30a electricity supply in all dwellings are to be provided to the cooker space.

If a cooker panel is provided it needs to be positioned to the side of the cooker space. A 13a socket outlet should be positioned at the cooker space where a gas supply is provided to the dwelling.

### Light fittings

At least one fixed lighting outlet should be provided to all rooms. Areas greater than 25m<sup>2</sup> are to be provided with two fixed lighting outlets.

Halls, landings and staircases are to be provided with lighting outlets and two-way switches.

Down lighters and other flush fitting attachments should not be installed through a ceiling if the ceiling is providing part of the required acoustic insulation or fire resistance to the property.

If down lighters are provided to ceilings below roof voids (excluding thatched roofs), precautions are to be taken to ensure that no fire risk is caused by the proximity of other materials.

(PIR) sensors are to be used in common and external areas to dwellings.

**Positioning of sockets and switches**

Sockets and switches should be positioned in accordance with Figure 11

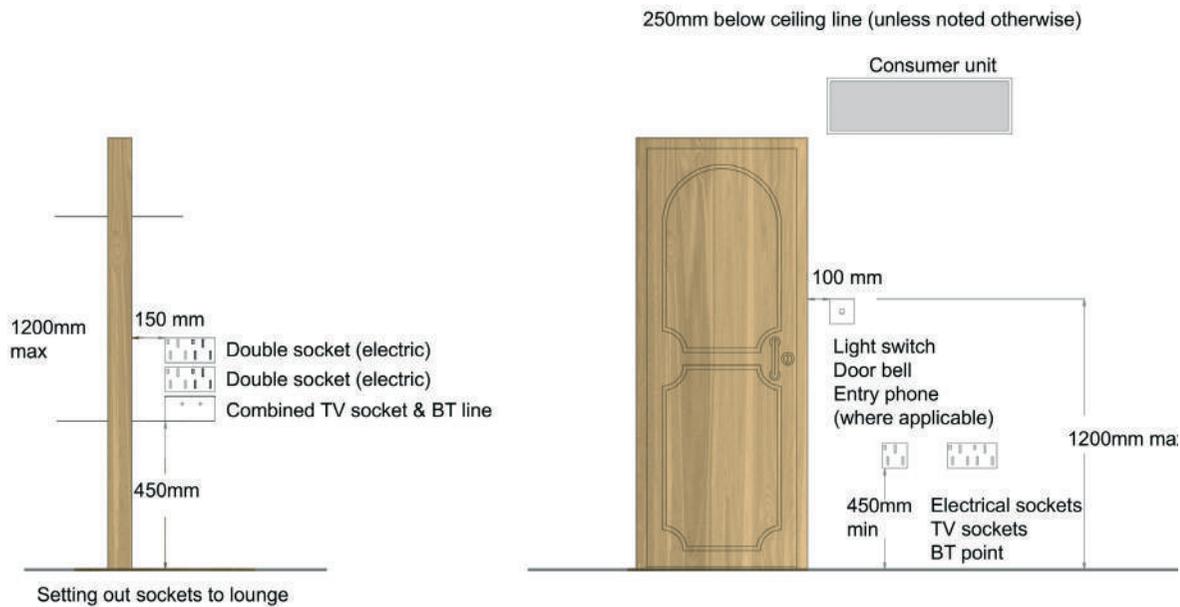


Figure 11: Heights of wiring accessories

# FUNCTIONAL REQUIREMENT

## 9.4. Hea Ting anD MeCHaniCal ServiCeS

### Workmanship

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### Materials

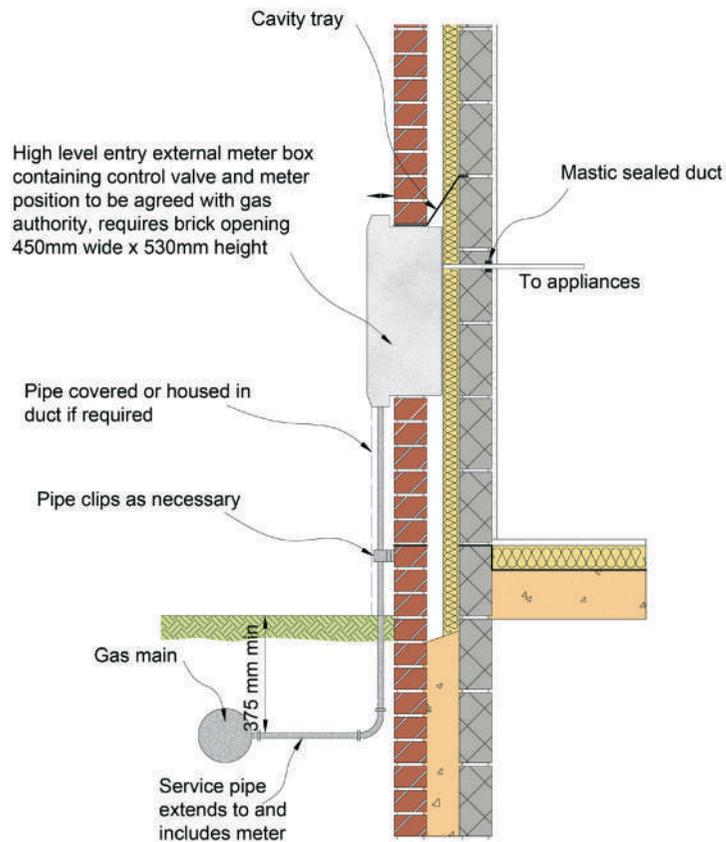
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### Design

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9.4.1 gas service

Where provided, the gas service shall be of a suitable scale for normal domestic usage.



A meter control valve is to be fitted on the supply side of the meter.

External meter boxes should be of a type approved by the supply authority and located as close as practical to the main access point to the dwelling.

Domestic meters may be of the following type:

- Built-in to the outer leaf of the wall.
- Surface-mounted: on an external wall.
- Semi-concealed: sunk into the ground adjacent to the outer wall.
- Individually purpose-made compartments – in accordance with British Standards.

All water services are to have precautions so that they are not subject to chemical attack.

Corrosion resistant materials should be used for pipes and fittings for water services. The recommendations of the water supplier should be adhered to.

Figure 12: gas service pipes

9.4.2 Cold water services

Each dwelling should have an adequate supply of cold water. The water supply should be fed from below ground and insulated in accordance with Figure 13 to prevent freezing.

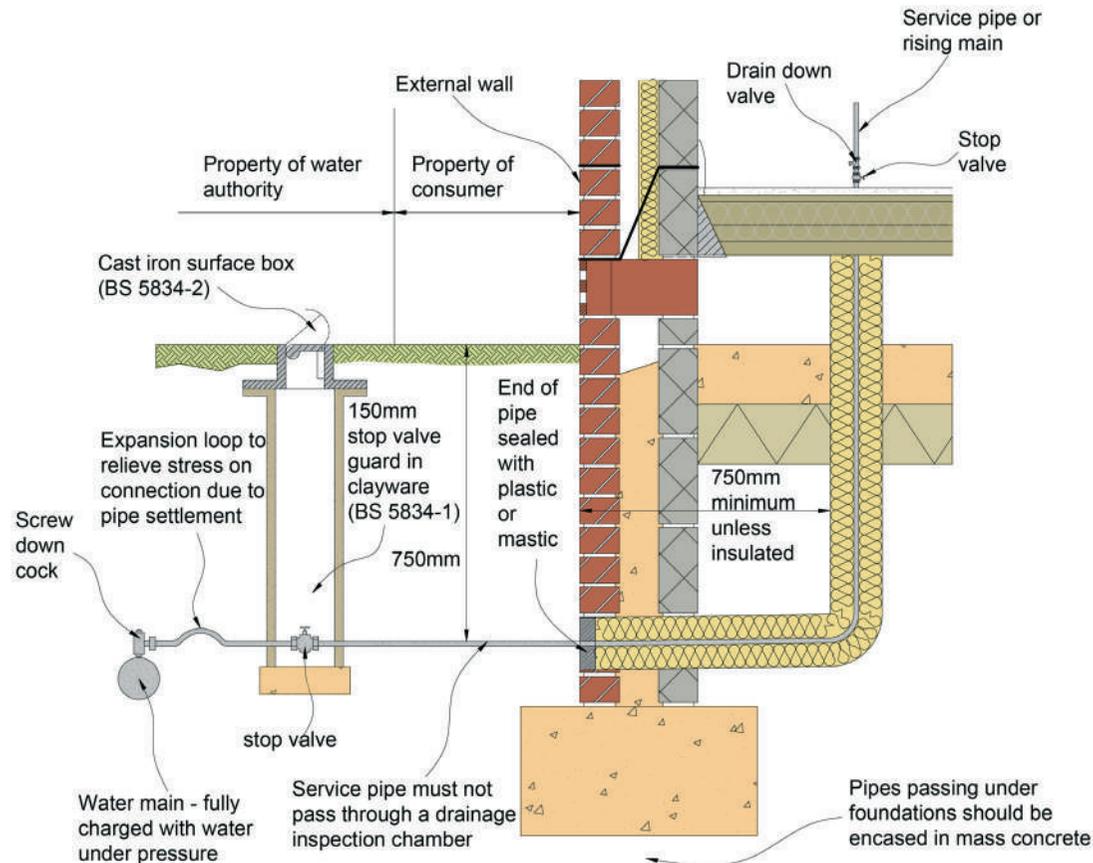


Figure 13: insulation of incoming services

Cold water systems may have provision for storage or directly connected to the main supply. Drinking water needs to be supplied direct from the supply main.

Cold water pipes and storage cisterns located in roof spaces and other unheated areas should be appropriately insulated to the relevant standards. Cold water storage cisterns will require the capacity specified in the design. Suitable support should be given for the cistern filled with water.

To stop the cistern bottom being deformed permanent support is to be given where necessary.

Adequate materials for support platforms are:

- Softwood boarding.
- Marine plywood.
- Chipboard type P5.
- Oriented strand board type OSB3 to British Standards.

All water tanks should be accessible. Gangway boarding is required to each cistern opening from the roof space access. An area of 1m<sup>2</sup> of boarding is to be provided next to cisterns permitting routine maintenance.

Water storage cisterns should be protected from contamination by a rigid close fitting cover (which is not airtight) which excludes light and insects.

Holes should be formed with a cutter in the positions shown in the design.

Overflows in warning pipes should be not less than 19mm diameter and situated 25mm from the shut off water level in the cistern. The pipe may dip below the water level in accordance with water regulations. Alternatively, the pipe should terminate vertically downwards or a tee should be fitted horizontally at the discharge end.

**9.4.3 Hot water services**

Hot water systems may have provision for storage or may be of the instantaneous type, e.g. combi boilers.

Vertical installation of cylinders is required with access.

Cylinders are to be insulated as specified in the design.

Where an immersion heater is fitted, it should be:

- Appropriate for the type of water supplied to the dwelling.
- Thermostatically controlled.
- Located so that it can be withdrawn for replacement.
- Fitted with an on/off switch.

Cisterns, vent pipes and all water services in unheated spaces should be insulated against freezing as specified in the design. Insulation is not to be placed below a cold waste tank where it can benefit from heat from beneath. Tanks that are raised need to be insulated on all sides in an unheated roof space.

Fully insulated bends and junctions are required especially near openings to the outside air, such as the eaves. If possible, water pipes should not be located within the loft space where they could be affected by cold ventilation air.

**9.4.3.1 Provision for expansion**

An expansion pipe is to be provided on vented systems for hot water.

**9.4.3.2 unvented hot water systems**

A third party accreditation is required where an unvented hot water system with a storage capacity greater than 15 litres is required by the design. Installation is to be completed by a competent person.

**9.4.3.3 Draining down facility**

Hot and cold water installations require the capability to be drained down.

**9.4.4 use of materials**

Materials which are safe and minimise the risk of corrosion are to be used for pipes and fittings for water services. The recommendations of the water supply with materials and fittings should be followed.

It may be necessary to fit aluminium protector rods in areas where putting corrosion of copper cylinders occurs. These are to be fitted during manufacture in accordance with the relevant British Standards.

**9.4.5 Space heating**

Any whole house heating system should be designed to meet internal temperatures to the levels set out as per below. The external temperature is to be 3°C.

location	Temperature	air changes
Living room	21°C	1 per hour
Dining room	21°C	1 per hour
Kitchen	18°C	2 per hour
Bedrooms	18°C	1 per hour
Bed-sitting room	21°C	1 per hour
Bathrooms	22°C	2 per hour
Hall and landing	16°C	2 per hour
Separate WC	18°C	2 per hour

Table 3: Whole house heating system - temperatures

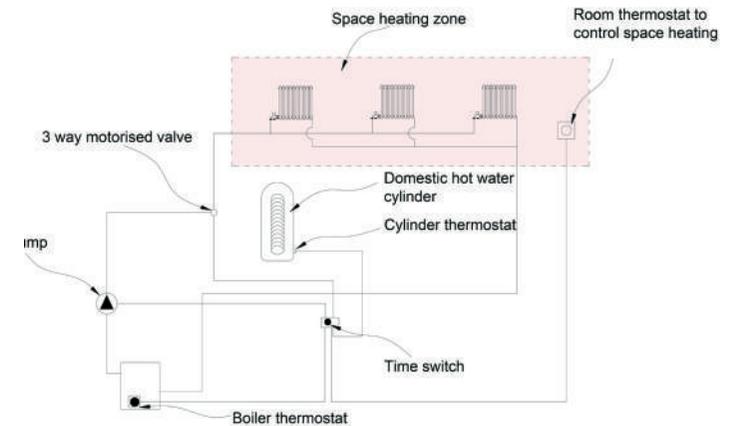


Figure 14: Controls for combined space heating and domestic hot water

Controls for wet heating systems are to be provided as follows:

- Room thermostat controlling the heater unit.
- Time switch allowing at least two heating periods a day. In the case of electrically heated storage systems (Electricaire), there will normally be a further time switch to control the electrical ‘charging’ periods to conform within the chosen tariff.
- A programmer to select:
  - Hot water
  - Space heating
  - Hot water and space heating

A thermostat which is sensitive to the room air temperature should be provided for independent heaters.

The boilers chosen for each dwelling should be based on their efficiency within the PCDF list. The efficiency of the boiler should be no less than the table below:

Central heating system fuel	PCDF% (2009)
Mains natural gas	88
LPG	88
Oil	88

**Table 4: Minimum efficiencies of heating systems**

**9.4.6 ventilation**

room	intermittent extract	Continuous extract
Kitchen	30 l/s adjacent to hob Or 60 l/s elsewhere	13 l/s
Utility (access via dwelling)	30 l/s	8 l/s
Bath/shower room	15 l/s	8 l/s
Sanitary accommodation	6 l/s	6 l/s

**Table 5: extract ventilation rates**

**9.4.7 extractor fans**

Where ductwork from extractor fans goes through unheated spaces such as roof voids, action should be taken to minimise the chance of condensation forming in the ducting and any consequential damage caused to finishes and the fan unit:

- Ensure ducting discharges to the outside air.
- Provide insulation to the outside of the ductwork and lay to a fall away from the fan.

The system should provide rates in accordance with Approved Document K.

All habitable and service rooms within dwellings should have some form of ventilation as a requirement. It may be permanent background ventilation, mechanical ventilation or an opening window.

Provide either 15 minutes overrun to the mechanical extractor unit, in internal rooms. PSV or an open flue heating appliance may be acceptable, in all cases some form of air inlet is required.

9.4.8 extract ducts

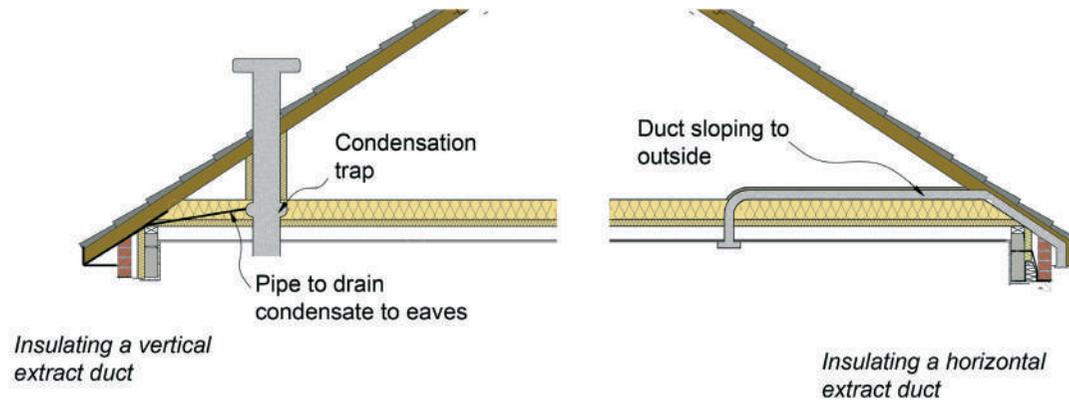


Figure 15: extract ducts

Adequate support is required for extract ducts and they also need to have sealed joints where required. Insulation needs to be provided where ducts pass through unheated spaces, such as roof voids, to the outside air, or a condensation drain should be provided in accordance with the design.

Where ducting is part of a Mechanical Ventilation and Heat Recovery System, it should be insulated in accordance with the manufacturer’s recommendations.

Where a gas appliance requires an electrical supply, a suitably fixed spur or socket outlet should be provided.

A concealed co-axial cable should be provided from the roof void to a terminal outlet within the main living room. Where the co-axial cable is not provided, a conduit and draw wire or an alternative should be provided. The provision of an aerial is not required.

9.4.9 Whole building ventilation

The whole building ventilation rate for the supply of air to the habitable rooms in a dwelling should be no less than below:

ventilation	Number of bedrooms in dwelling				
	1	2	3	4	5
Whole building ventilation rates (l/s)	13	17	21	25	29

Table 6: Whole building ventilation rates

9.4.10 Passive stack ventilation

The system is to meet the relevant third party accreditation.

The PSV layout should be designed to:

- Avoid cross flow between the kitchen and bathroom / WCs.
- Prevent, as far as possible, air flow in the ducts being adversely affected by the prevailing wind speed and direction, or by sudden changes in these.
- Minimise resistance to air flow by having ducts that are as near vertical as possible.

To ensure good transfer of air throughout the dwelling, there should be an undercut of minimum area 7600mm<sup>2</sup> in all internal doors above the floor finish (equivalent to an undercut of 10mm for a standard 760mm width door).

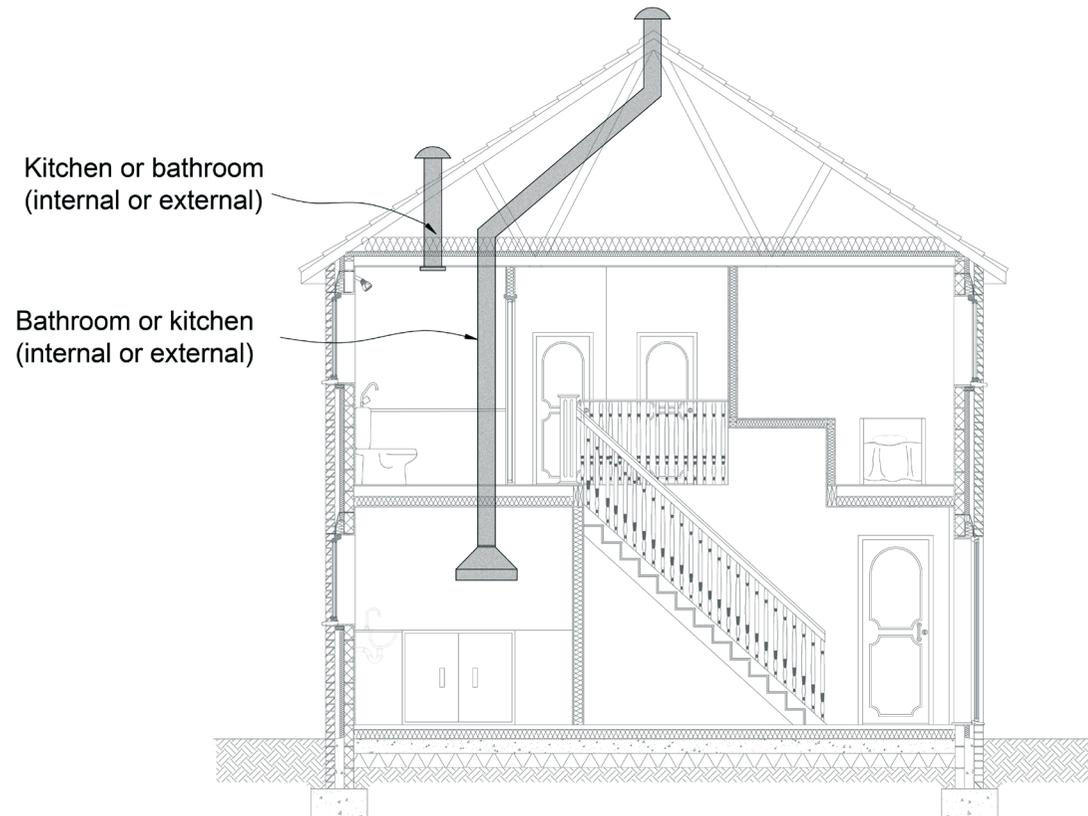


Figure 16: Passive stack ventilation

#### 9.4.11 installation of building services

All items should be installed to ensure satisfactory operation.

Items to be taken into account include:

- Location and fitting of pipe and cables service entries through the substructure.
- Where necessary to prevent damage to the service and be sleeved or ducted where passing through structural elements (not solidly embedded).
- Not be located in the cavity of an external wall, except for electricity meter tails.
- Only be buried in screeds where permitted by relevant Codes of Practice.

Where copper pipes are permitted in floor screeds they should be:

- Sleeved or wrapped so that they can move freely along the length and at joints and bends.
- Jointed with capillary joints.

A metallic tape should be applied to the pipework where plastic pipework is in or behind wall surfaces, and would otherwise not be located by a metal detector.

#### 9.4.12 Jointing of pipes and fittings

Proprietary joints should be made strictly in accordance with the manufacturer's instructions.

Only fluxes recommended by the Pipe Manufacturer should be used and all traces should

be removed immediately after jointing. Fluxes containing lead are not acceptable.

Suitable clips or brackets are to be used to secure. Fixings should be installed adequately and spaced to stop sagging but not restrict thermal movement. Where needed pipes should have adequate falls.

Sufficient room should be allowed for thermal expansion and contraction to avoid damage and noise from pipe movement.

Holes should be kept apart by at least three times holes diameter.

#### 9.4.13 notches and drillings

Floor joists should not be excessively notched or drilled. Further guidance can be found in Chapter 8 of this Manual.

#### 9.4.14 Concealed services

If the services are hidden in walls or floors they need to be positioned so that any significant cracking of the surface cannot happen.

#### 9.4.15 Wall chasing

If chases in walls are necessary, their depth should not exceed

- One sixth the thickness of the single leaf for horizontal chases.
- One third the thickness for vertical chases.

Hollow blocks should not be chased unless specifically permitted by the manufacturer.

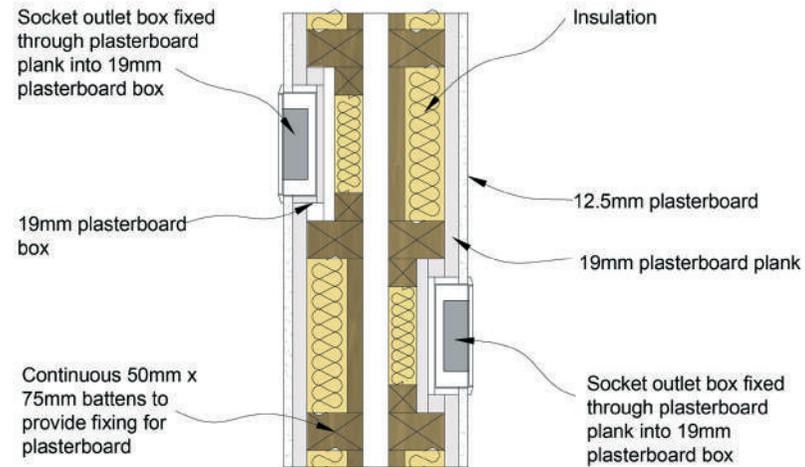


Figure 17: Staggered services on party walls

#### 9.4.16 Services within or beneath floors

Protection through wrapping or ducting is necessary when pipes are situated under floor screeds. Thermal expansion allowances are to be made especially at changes of direction.

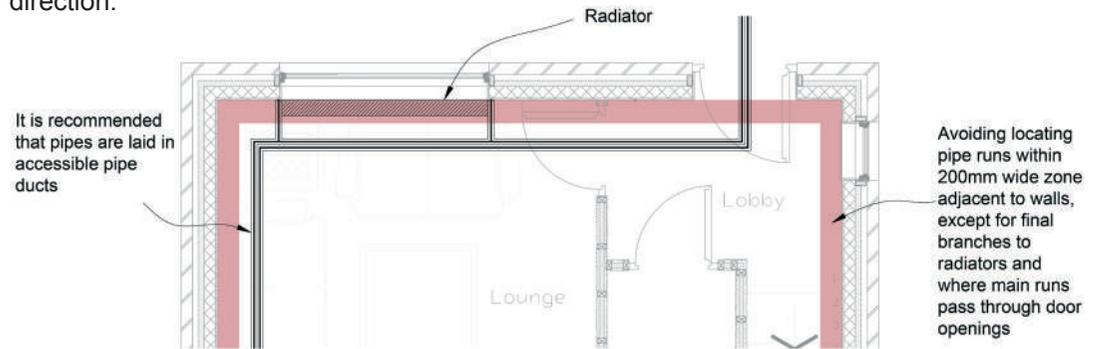


Figure 18: recommended positioning of pipes in screeds

## CHAPTER 9: Building Services

The insulating material around the pipework needs to be a minimum of 25mm thickness. The screed thickness should still be at least 25mm where pipes cross over.

### 9.4.17 Fire-stopping

Fire-stopping is required around services that penetrate fire-resisting floors, walls or partitions. If proprietary systems are used they should be installed using manufacturer's recommendations.