
Part 8

Services and internal finishing

- 8.1 Internal services
- 8.2 Wall and ceiling finishes
- 8.3 Floor finishes
- 8.4 Finishings and fitments
- 8.5 Painting and decorating



Chapter 8.1

Internal services



8.1 Internal services

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SCOPE

This Chapter gives guidance on meeting the Technical Requirements and recommendations for internal services, including plumbing, hot and cold water supply, and gas, electric and solid fuel heating installations.

DESIGN STANDARDS

8.1 - D1 Design shall meet the Technical Requirements

Design that follows the guidance below will be acceptable for internal services.

STATUTORY REQUIREMENTS

8.1 - D2 Design shall comply with all relevant statutory requirements

Designs should be in accordance with relevant Building Regulations and other statutory requirements.

STRUCTURAL STABILITY

8.1 - D3 The design of internal services shall not adversely affect the stability of the dwelling

Notching, drilling and chasing to accommodate service pipes and cables should either:

- comply with Sitework clauses 8.1 - S2(d) and (e), or
- be designed by an Engineer.

PRECAUTIONS AGAINST GROUND HAZARDS

8.1 - D4 Design of service entries shall take account of ground hazards

In certain parts of the country, special precautions are necessary to reduce the entry of radon gas. Areas in England and Wales where special precautions are necessary are detailed in BRE Report 211 'Radon: guidance on protective measures for new dwellings'.

Where landfill and other gases are present precautions are necessary to prevent entry. Details are shown in BRE Report 212 'Construction of new buildings on gas-contaminated land'.

PRECAUTIONS AGAINST CHEMICAL ATTACK

8.1 - D5 Adequate precautions shall be taken to ensure services are not subject to chemical attack

WATER SERVICES

Pipes and fittings for water services should be of materials which are resistant to corrosion. The recommendations of the water supplier should be followed as to the compatibility of the water supply with materials and fittings.

ELECTRICAL SERVICES

PVC covered cables should not be in contact with polystyrene insulation.

WATER SUPPLY

8.1 - D6 Water service design shall be in accordance with statutory requirements and based on the pressures and flow rates supplied from the incoming main

Water services should be in accordance with relevant Building Regulations and other statutory requirements.

The design of the water service should be based on a minimum dynamic pressure of 1.5 bar at the stopvalve inside the home.

The design should ensure that a minimum flow rate of 20L/min is available at the stopvalve inside the home.

The design should take account of:

- pressure and flow rate reductions where there are long distances between the water main and the stopvalve inside the building. This may involve increasing the diameter of the supply pipe
- pressure fluctuations, or surges, which may occur within the system and the potential damage they may have on fittings. Surge arresters may need to be installed at suitable points within the system.

COLD WATER SERVICE

8.1 - D7 Adequate cold water services shall be provided

Items to be taken into account include:

(a) drinking water

Drinking water should be provided at the kitchen sink. The supply should come direct from the supply pipe or, where this is impracticable, from a storage cistern containing an adequate supply of wholesome water. Further information is given in Water Regulations and guides.

(b) cold water storage

Cold water storage should be provided:

- to supply an open vented hot water storage system
- where required by the water supplier
- to supply those cold water outlets not connected to the supply pipe.

The cold water storage capacity should take account of the guidance in BS 6700, which recommends:

"In small houses it is usual for storage cisterns supplying only cold water fittings to have a capacity of 100L to 150L, and double this capacity if supplying all water outlets, hot and cold.

In larger houses a total storage capacity of 100L per bedroom is recommended".

Primary feed cisterns for indirect water heating systems should be of adequate capacity.

Cold water storage cisterns should be accessible for inspection and maintenance.

Storage cisterns should have rigid close fitting covers (which are not airtight) and which exclude light and insects.

(c) warning and overflow pipes

Warning and overflow pipes should be of adequate size and be provided from all cold water cisterns to a suitable discharge outside of the building. Where permitted by water regulations, the discharge may be internal provided it is conspicuous.

(d) reducing the risk of freezing

Pipes and cisterns should be located in the warm envelope of the home to reduce the risk of freezing.

Where pipes and cisterns are placed in unheated spaces, they should be adequately insulated to reduce the risk of freezing (see BS 6700 and Appendix 8.1-A).

HOT WATER SERVICE

8.1 - D8 An adequate hot water service shall be provided in accordance with statutory requirements

Hot water services should be in accordance with relevant Building Regulations and other statutory requirements.

8.1 - D9 The hot water services shall be adequate for the likely demand and consumption

Items to be taken into account include:

(a) types of system

- instantaneous systems (combination boiler)

These systems produce hot water on demand, but generally at significantly lower flow rates than storage systems. They should only be used where the simultaneous demand for hot water is limited e.g. in homes with only one bathroom or shower room, unless the boiler manufacturer can show that the boiler is capable of producing hot water simultaneously to outlets in accordance with clause D9(c).

For storage combination boilers, whose characteristics are similar to storage systems, the storage capacity should meet with the guidance in (b) below.
- storage systems (vented cylinder, unvented hot water storage system, primary store)

These systems provide higher flow rates than instantaneous systems but require a suitable space for the siting of the storage vessel.

(b) hot water storage

Hot water storage for notional draw-off requirements should be not less than shown in the following table. Where appliances are to be installed requiring greater amounts of hot water, the storage capacity should be increased accordingly:

8.1 Internal services

Home with			
Shower only	Bath only	Bath and shower(s*)	Two baths
60L	120L	145L	180L

*max. 2 showers (excludes instantaneous electric showers)

For systems heated by off-peak electricity, the storage capacity should be in accordance with the recommendations of the electricity supplier.

Where boiler outputs are controlled and can prioritise hot water then storage capacities can be less than the figures in the table. Some storage combination boilers and combined primary storage units (CPSU) have this facility. The manufacturer should be consulted on the appropriate storage capacity for the likely hot water demand.

For homes with a single bathroom/shower room, it is assumed that immediately after filling a bath, some hot water may be required for kitchen or wash basin use, but a second bath will not be required for another 20 or 30 minutes.

For homes with two or more bathrooms, it is assumed that all the installed baths will be filled in succession and that some hot water may be required for kitchen or wash basin use immediately after.

The quantities of hot water stored are based on a water draw off temperature of 60°C.

(c) flow rates and temperature

The system should be designed and installed so that the following flow rates and temperatures are available:

Outlet	Flow Rate L/s		Supply temperature
	Design Rate (see note 1)	Minimum Rate (see note 2)	
Bath (from storage)	0.3	0.2	60°C
Bath (from combi)	0.2	0.15	40°C
Shower (see note 3)	0.2	0.1	40°C
Wash Basin	0.15	0.1	40°C
Sink	0.2	0.1	60°C

Notes

- The design flow rate should be available at each outlet when the total demand does not exceed 0.3L/s. When simultaneous discharge occurs, the flow rate at an individual outlet should not be less than the minimum rate.

2 The minimum flow rate should normally be available, based on clause D6, but may be less if the pressure and flow rate of the incoming supply falls below 1.5 bar.

3 Excludes instantaneous electric showers.

4 Further information on flow rates and temperatures can be found in BS 6700.

(d) unvented hot water storage systems

Unvented hot water storage systems should be assessed in accordance with Technical Requirement R3 or meet the requirements of BS 7206, and be the subject of a third party certification scheme (e.g. Kitemarking).

(e) safety in showers

Where a shower is installed, adequate provision should be made to ensure that the outlet temperature of the water is not seriously affected by the use of other hot or cold outlets in the dwelling. This may be achieved by the provision of a thermostatic shower mixing valve, appropriate design of pipe sizes or dedicated supplies.

ELECTRICAL SERVICE

8.1 - D10 The electrical installation shall be provided in accordance with relevant regulations

All electrical installations should comply with BS 7671.

Cables which are covered or surrounded by thermal insulation may need to be de-rated. Guidance is available in the BRE report 'Thermal insulation: avoiding risks'.

8.1 - D11 An adequate electrical service shall be provided

Items to take into account include:

(a) cooking

In all dwellings, a minimum 30A electricity supply, suitably switched and terminated, should be provided to the cooker space.

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

(b) socket outlets

Rooms should be provided with not less than the following 13A outlets. Dual outlets count as two.

Room	Outlets	Notes
Kitchen/utility	8	Where homes have separate areas, the kitchen should have a minimum of 4 outlets, and the utility room 4. Where appliances are provided, at least 3 outlets should be free for general use
Dining room	4	
Living or family room	8	At least 2 outlets should be near the TV aerial outlet
Bedrooms	6 (4)	6 for main bedroom 4 for other bedrooms
Landing	2	
Hall	2	

(c) lighting

Every room should have at least one fixed lighting outlet.

Lighting outlets should be provided to halls, landings and staircases. At each floor level two-way switching should be provided to staircases.

In common areas to dwellings, artificial lighting should be provided, controlled by either manual switching by persons using the area or automatic light sensitive controls.

(d) fixed appliances

EXTRACT FAN SYSTEMS

Extract fan systems should be designed in accordance with the manufacturer's recommendations. Ducts passing through unheated spaces, such as a roof void, to the outside air should be insulated to prevent condensation affecting the operation of the fan. Alternatively, the ducting should have a means of collecting the condensate and draining it to the outside. Where ducting is part of a mechanical ventilation and heat recovery system it should be insulated in accordance with the manufacturer's recommendations.

ELECTRICAL SUPPLY TO GAS APPLIANCES

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

(e) television

A concealed co-axial cable should be provided from the roof void to a terminal outlet in 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.

GAS SERVICE

8.1 - D12 Where provided, gas services shall be adequate and in accordance with relevant standards and codes

All gas services must comply with the Gas Safety (installation and use) Regulations.

British Standards relevant to the design of gas installations include BS 6891 and for Butane and Propane gas, BS 5482. Other authoritative publications such as those prepared by the Institution of Gas Engineers and Managers and Gas Safe Register (GSR) can be used.

Gas pipework to be installed in timber frame construction should allow for the likely differential movement. Reference should be made to Chapter 6.2 'External timber framed walls'.

Where a gas supply is provided, there should be a gas point at the cooker space.

For details of hearths, flues and air supply, refer to Chapter 6.8 'Fireplaces, chimneys and flues'.

8.1 - D13 Where provided, gas services shall be adequate

Meters and associated equipment should be located where they are reasonably accessible and not subject to damage. 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 the recommendations of BS 6400.

SPACE HEATING

8.1 - D14 Where space heating is provided it shall be in accordance with relevant standards

British Standards relevant to heating systems include BS 5449, BS 5410 and BS 8303.

Underfloor heating systems should be designed in accordance with BSRIA guides AG12 and 13.

8.1 - D15 Space heating shall be adequate

Items to be taken into account include:

(a) minimum standards for living room heating

The main living room of a dwelling should have a heating appliance or a heat output as part of whole home heating which is capable of maintaining a temperature of at least 21°C in the room when the outside temperature is -3°C.

(b) minimum standards for whole home heating

The provision of whole home or central heating is discretionary. Where it is provided, it should be designed to recognised standards and based generally on the following:

- external temperature -3°C
- the design temperatures and ventilation rates given in the table below:

Room	Room temperature (°C)	Ventilation rate (air changes per hour)
Living room	21	1.5
Dining room	21	1.5
Bedroom	18	1
Hall and landing	18	1.5
Kitchen	18	2
Bathroom	22	2
Toilet	18	2

Notes

- 1 The number of air changes per hour from kitchens and bathrooms should take account of any mechanical ventilation installed.
- 2 Where rooms contain open flued appliances, the rate of air change used for the design should be increased (see BS EN 12828).
- 3 In case of dispute, the design temperatures adopted should be verified by calculations and not by performance tests.

(c) safe operation of heating appliances

Reference should be made to Sitework clause 8.1 - S7 and Chapter 6.8 'Fireplaces, chimneys and flues' for guidance on:

- location of appliances
- provision for supply of combustion air and removal of combustion products
- separation from combustible materials.

SOIL AND WASTE SYSTEMS

8.1 - D16 Internal soil and waste systems shall be designed in accordance with relevant statutory requirements

Designs should be in accordance with relevant Building Regulations and other statutory requirements.

8.1 - D17 Internal soil and waste systems shall be adequate

Items to be taken into account include:

(a) disposal of effluent from the building

Soil and waste systems should comply with any specific requirements from the water supplier.

Guidance and recommendations for building drainage and sanitation are given in BS EN 752 and BS EN 12056.

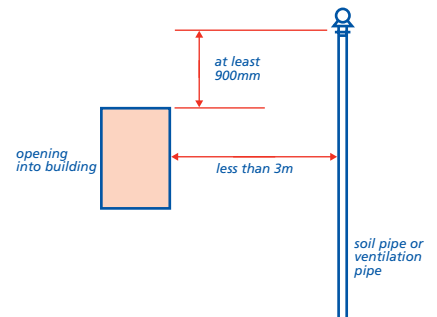
(b) entry of foul air from the drainage system to the building

Soil and waste systems should be arranged so that:

- each branch is adequately ventilated
- foul air from the drainage system cannot enter dwellings.

Ventilation should be provided at the head of underground drains. This may be by a soil pipe or separate ventilation pipe.

Where a soil pipe or ventilation pipe is less than 3m away from an opening into the building, it should extend at least 900mm above that opening.



(c) air admittance valves

Air admittance valves 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 EN 12380 or be assessed in accordance with Technical Requirement R3. 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.

(d) entry of vermin

Entry of vermin should be prevented.

(e) noise transmission

Precautions should be taken to limit noise transmission from rooms containing WCs, for example:

- soil pipes passing through dwellings should be encased and insulated; the insulation should be continued through the thickness of any sound-insulating floor
- walls between living rooms and rooms containing WCs should be insulated as recommended in Chapter 6.3 'Internal walls' (Design). In England and Wales, reference should be made to statutory requirements.

Sound insulation should be detailed in accordance with Sitework clause 8.1 - S8(c).

PROVISION OF INFORMATION

8.1 - D18 Designs and specifications shall be produced in a clearly understandable format and include all relevant information

For internal services drawings should show:

- 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
- heating boiler and heat emitters
- central heating pipe runs
- gas supply pipe runs
- electrical outlets, switches and consumer unit.

8.1 - D19 All relevant information shall be distributed to appropriate personnel

Ensure that design and specification information is issued to site supervisors and relevant specialist subcontractors and/or suppliers.

MATERIALS STANDARDS

8.1 - M1 All materials shall:

- (a) meet the Technical Requirements**
- (b) take account of the design**

Materials that comply with the design and the guidance below will be acceptable for internal services.

Materials for internal services should comply with all relevant standards, including those listed below. Where no standards exist, Technical Requirement R3 applies (see Chapter 1.1 'Introduction to the Standards and Technical Requirements').

References to British Standards and Codes of Practice include those made under the Construction Products Directive (89/106/EEC) and, in particular, appropriate European Technical Specifications approved by a European Committee for Standardisation (CEN).

PRECAUTIONS AGAINST CORROSION

8.1 - M2 Materials for internal water services shall be selected to ensure satisfactory service for the life of the systems, taking suitable precautions against corrosion

Pipes and fittings for water services should be of materials which are safe and minimise the risk of corrosion. The recommendations of the water supplier should be followed as to the compatibility of the water supply with materials and fittings.

In areas where pitting corrosion of copper cylinders occurs, it may be necessary to fit aluminium protector rods. These should be fitted during manufacture in accordance with the relevant British Standard.

The water supplier may require a sacrificial anode to be fitted.

Further guidance is given in BS EN 806.

MATERIALS AND APPLIANCES

8.1 - M3 Materials and components shall comply with relevant codes and standards and be approved by relevant authoritative organisations

Items to be taken into account include:

(a) water services

Recommendations of the relevant water supplier

- | | |
|------------|---|
| BS EN 806 | Specifications for installations inside buildings conveying water for human consumption. |
| BS 7206 | Specification for unvented hot water storage units and packages. |
| BS EN 1057 | Copper and copper alloys - seamless round copper for water and gas in sanitary and heating applications. |
| BS 1566 | Copper indirect cylinders for domestic purposes. |
| BS 3198 | Specification for copper hot water storage combination units for domestic purposes. |
| BS 7291 | Thermoplastics pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings. |

(b) electrical service

Recommendations of the relevant electricity suppliers

- | | |
|---------|---|
| BS 7671 | Requirements for electrical installations |
| BS 6004 | Electric cables. PVC insulated, non-armoured cables for voltages up to and including 450/750V for electric power, lighting and internal wiring. |

(c) gas service

Recommendations of the relevant gas transporters and suppliers

- | | |
|---------|---|
| BS 6400 | Specification for installation of domestic gas meters (2nd family gases) |
| BS 6891 | Specification for installation of low pressure gas pipework of up to 35mm (R1) in domestic premises (2nd family gases). |

(d) space heating

- | | |
|-------------|---|
| BS 5410 | Code of Practice for oil firing |
| BS 5449 | Code of Practice for central heating for domestic premises |
| BS 8303 | Code of Practice for installation of domestic heating and cooking appliances burning solid mineral fuels. |
| BS EN 12828 | Heating systems in buildings - design for water-based heating systems. |

(e) space heating appliances

Space heating appliances, including all components and controls should be a type approved by the relevant authority, including:

- Solid fuel Solid Fuel Association, Heating Equipment Testing and Approval Scheme
- Electricity British Electrotechnical Approvals Board
- Gas Advantica plc
- Oil OFTEC
- LPG Advantica plc

(f) soil and waste systems

- | | |
|-------------|---|
| BS EN 12056 | Gravity drainage systems inside buildings |
|-------------|---|

SITWORK STANDARDS

8.1 - S1 All sitework shall:

- (a) meet the Technical Requirements
- (b) take account of the design
- (c) follow established good practice and workmanship

Sitework that follows the design and the guidance below will be acceptable for internal services.

INSTALLATION: GENERAL

8.1 - S2 All services shall be installed to ensure satisfactory operation

Items to be taken into account include:

(a) location and fitting of pipes and cables

Service entries through the substructure should be constructed as described in Chapter 5.1 'Substructure and ground bearing floors' (Design and Sitework).

Services should:

- where necessary to prevent damage to the service, 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.

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

(b) 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.

(c) fixing of pipes

Pipes should be adequately secured with suitable clips or brackets. Fixings should be installed neatly and spaced to prevent sagging but not restrict thermal movement. Pipes should have adequate falls, where appropriate.

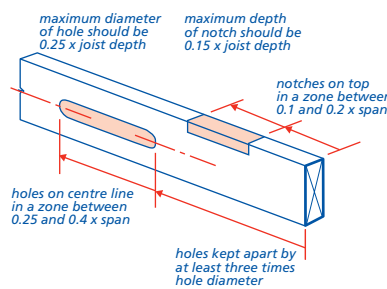
Sufficient room should be allowed for thermal expansion and contraction to avoid damage and noise from pipe movement.

(d) notching and drilling of joists

SOLID TIMBER

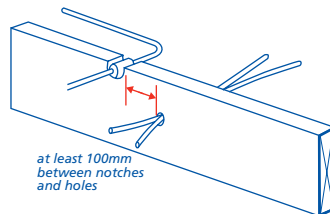
Solid timber joists and studs should only be notched and drilled within the limits shown in the table below:

Item	Location	Maximum size
Notching joists up to 250mm depth	top edge 0.1 to 0.2 of span	0.15 x depth of joist
Drilling joists up to 250mm depth	centre line 0.25 to 0.4 of span	0.25 x depth of joist
Drilling studs	centre line 0.25 to 0.4 of height	0.25 x depth of stud



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

Notches and drillings in the same joist should be at least 100mm apart horizontally.



Special instructions should be obtained from the designer when notching and drilling:

- is required in joists deeper than 250mm
- does not meet the above guidelines, or
- is needed close to heavy loads, such as those from partitions, cisterns, cylinders and stair trimming.

If structural strength is impaired by notching or drilling the element should be replaced or correctly repaired.

I-JOISTS

In I-joists pre-formed holes are provided in the timber webs for pipes and cables. Other holes and notches should not be cut without the approval of the manufacturer.

METAL WEB JOISTS

In metal web joists services should run in the gaps between the metal webs. Where services are in conduits, the conduits may have to be inserted before fixing the joists in position. Reference should also be made to Chapter 6.10 'Light steel framed walls and floors' (Sitework).

(e) concealed services

Services concealed in walls or floors should be located so that significant cracking of the surface does not occur.

WALLS

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

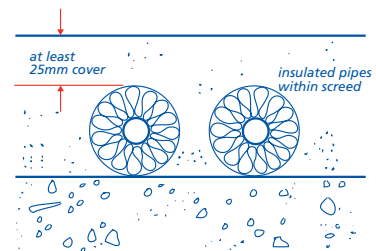
- one-sixth the thickness of the single leaf for horizontal chases
- one-third the thickness for vertical chases.

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

FLOORS

Pipes under floor screeds should, where necessary, be protected by wrapping or ducting. Allowance should be made for thermal expansion, especially at changes of direction.

The cover over a pipe or pipes, or any insulating material should be at least 25mm. Where pipes cross over, the screed thickness should still be not less than 25mm and it may be necessary to form a duct to achieve adequate cover. In an in-situ suspended concrete floor, the location and depth should be approved by the designer.

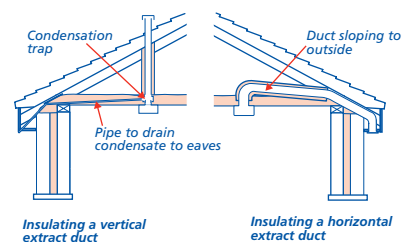


(f) fire-stopping

Fire-stopping should be provided around any services which penetrate fire-resisting floors, walls or partitions. Where a proprietary system, such as an intumescent seal, is used it should be installed in accordance with the manufacturer's instructions.

(g) extract ducts

Extract ducts should have sealed joints and be adequately supported. Ducts passing through unheated spaces, such as a roof void, to the outside air should be insulated or a condensation drain should be provided in accordance with the design.



HOT AND COLD WATER SERVICES

8.1 - S3 Hot and cold water services shall be installed to avoid mechanical, frost and corrosion damage

Items to be taken into account include:

(a) protection of the incoming service

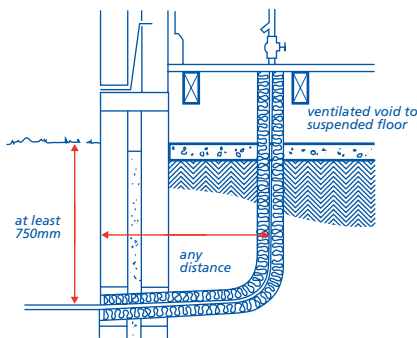
Any stop valve within the curtilage and outside the dwelling should be protected by a shaft or a box.

Service pipes should be at least 750mm below the ground surface. Where this is not possible, adequate precautions should be taken against frost and mechanical damage.

Any underground duct should be sealed at both ends to prevent the entry of fluids, vermin and insects.

(b) insulation of the incoming service

If the floor is of suspended construction, the underfloor water service should be insulated as it passes through the ground and the ventilated space.



(c) location of meters

If a water meter is built into the external wall of the dwelling, it should comply with Clause S6.

(d) provision of cold water storage

Cold water storage cisterns should have the capacity specified in the design. Adequate support should be provided for the cistern filled with water.

Water cisterns installed in roof spaces should be supported as described in Chapter 7.2 'Pitched roofs' (Design and Sitework). Continuous support should be provided, where necessary, to prevent the cistern bottom being deformed. Suitable materials for support platforms are:

- softwood boarding
- marine plywood
- chipboard Type P5 to BS EN 312
- Oriented strand board Type OSB3 to BS EN 300 laid with stronger axis (as marked on board) at right angles to the bearers.

All water tanks should be accessible. Gangway boarding should be provided from the roof space access opening to each cistern. An area of 1m² of boarding

should be provided next to cisterns to permit routine maintenance. The boarding should be constructed so that ceiling insulation is not compressed.

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 or 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.

(e) hot water storage

Hot water cylinders should be fully supported in accordance with manufacturers' recommendations.

Cylinders should be installed vertically, unless designed otherwise, and should be accessible.

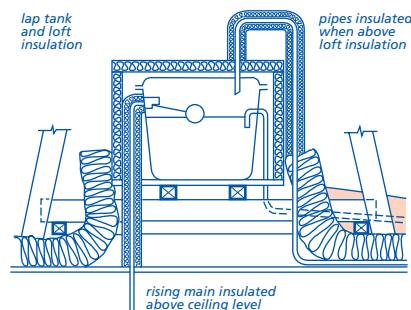
Cylinders should be insulated as specified in the design.

Where an immersion heater is fitted, it should be:

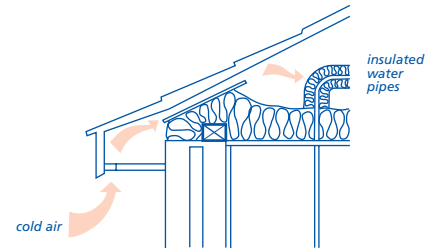
- appropriate for the type of water supplied to the dwelling
- thermostatically controlled
- located so that it can be withdrawn for replacement
- fitted with an on/off switch.

(f) thermal insulation of water services

All water services in unheated spaces, including cisterns and vent pipes, should be insulated against freezing as specified in the design. Insulation should not be placed beneath a cold water tank where it can benefit from heat from below. Raised tanks should be insulated on all sides in an unheated roof space.



All bends and junctions should be fully insulated, especially near openings to the outside air, such as the eaves, where there is an increased risk of freezing. If possible, water pipes should not be located within the loft space where they could be affected by cold ventilation air.



(g) provision for expansion

Vented systems should be provided with an expansion pipe.

(h) unvented hot water systems

Where an unvented hot water system with a storage capacity greater than 15 litres is required by the design, the assembled system with all its components should have independent third party assessment or meet the requirements of BS 7206 with third party assessment such as Kitemarking. Unvented hot water storage systems should be installed by competent installers.

(i) draining down facility

Hot and cold water installations should be capable of being separately drained down.

(j) use of materials

Pipes and fittings for water services should be of materials which are safe and minimise the risk of corrosion. The recommendations of the water supplier as to the compatibility of the water supply with materials and fittings should be followed.

In areas where pitting corrosion of copper cylinders occurs, it may be necessary to fit aluminium protector rods. These should be fitted during manufacture in accordance with the relevant British Standard.

ELECTRICAL SERVICE

8.1 - S4 Electrical services shall be installed to comply with relevant codes and standards and ensure safe and satisfactory operation

Items to be taken into account include:

(a) compliance with Standards

Electrical installations should comply with BS 7671 'Requirements for electrical installations'.

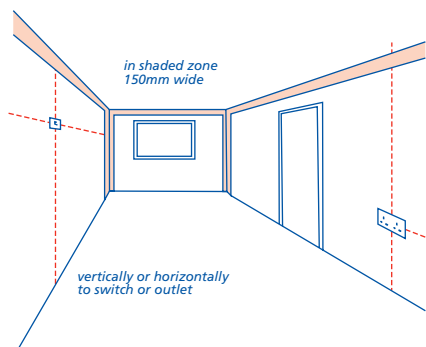
(b) manufacturers' recommendations

Any work involving material or equipment installed as part of the supply or use of electricity should be carried out in accordance with manufacturers' recommendations.

(c) location of electric cables

Cables without special protection, such as an earthed metal conduit, should be positioned as follows:

- vertically from the outlet or switch being served, or
- horizontally from the outlet or switch being served, or
- within the shaded zone in the diagram below, or
- not less than 50mm from the surface of a wall, or
- not less than 50mm from the top or bottom of a timber joist or batten in a floor or ceiling.



LOCATION OF CABLES WITHOUT SPECIAL PROTECTION

Where the position of switches or sockets can be determined from the reverse side of the wall or partition, the zone on one side of the wall or partition also extends to the reverse side.

(d) location of cables in relation to insulation

Cables should not be placed under, against or within thermal insulation, unless they have been appropriately sized. For further guidance, refer to the BRE Report 'Thermal insulation: avoiding risks'.

PVC covered cables should not be in contact with polystyrene insulation.

(e) location of socket outlets and switches

Socket outlets and switches on walls should be located in accordance with relevant Building Regulations.

GAS SERVICE

8.1 - S5 Where a gas service is installed, it shall comply with relevant codes and standards to ensure safe and satisfactory operation

Items to be taken into account include:

(a) compliance with Standards

Service pipework up to and including the emergency control valve and meter should be in accordance with the requirements of the gas transporter, gas supplier and primary meter owner. Installation pipework and appliances should meet with relevant standards and codes including those published by Institution of Gas Engineers

and Managers (IGEM) or Gas Safe Register (GSR).

Gas pipework to be installed in timber frame construction should allow for likely differential movement. Reference should be made to Chapter 6.2 'External timber framed walls'.

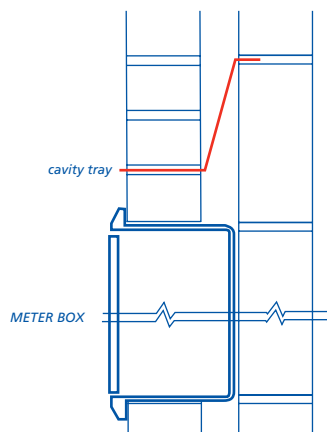
METERS

8.1 - S6 Openings in walls for meter cabinets shall be structurally adequate and prevent dampness entering the dwelling

EXTERNAL ELECTRICITY AND GAS METERS

Openings for electricity and gas meter cabinets set into external walls should be provided with dpcs and cavity trays.

Except for purpose-designed built-in meter boxes provided by gas and electricity companies lintels are required.



SPACE HEATING

8.1 - S7 Installation of space heating systems shall comply with relevant codes and standards and ensure safe and satisfactory operation

Items to be taken into account include:

(a) location and fitting of appliances
Reference should be made to Chapter 6.8 'Fireplaces, chimneys and flues'.

(b) location of warm air ducts

Warm air ducts for gas-fired air heaters should be installed in accordance with the design, and follow the manufacturer's recommendations.

(c) thermal insulation of heating services

All pipework and ductwork should be insulated as specified in the design.

(d) underfloor heating systems

Detailed guidance on underfloor heating systems is given in BSRIA guides AG12 and 13. Drawings should be made available on site showing the pipe routes.

SOIL AND WASTE SYSTEMS

8.1 - S8 Soil and waste systems shall be installed to ensure that effluent is removed without affecting health or creating unnecessary noise and smell

Items to be taken into account include:

(a) pipework

Soil and waste pipes should be fixed neatly and securely to provide correct falls.

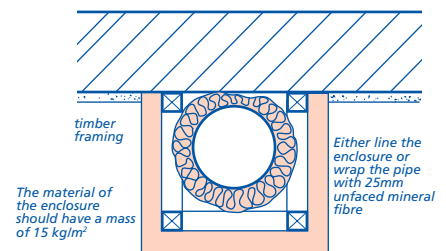
(b) sanitary fittings

Fixings to walls and floors should be appropriate for the weight of fittings. Excess packing should be avoided under sanitary fittings.

All sanitary fittings, cisterns, basin brackets and the like should be fixed with non-ferrous or stainless steel screws or fixings.

(c) sound insulation of pipes

Insulation should be provided to all soil pipes passing through dwellings.



(d) flexible joints/sealants

Junctions with wall tiling around baths and showers on joisted floors should be made with watertight flexible sealant to accommodate movement. The manufacturer's instructions should be followed.

(e) accessories

All specified accessories, such as chains, plugs, etc should be provided and installed. WC lids and seats should be stable when open.

(f) waste disposal units

Waste disposal units should have adequate provision for support and should be fitted with a tubular trap (not bottle or re-sealing) and be connected to the drainage system in accordance with the manufacturer's instructions.

(g) air admittance valves (AAVs)

AAVs should only be used where specified in the design. They should not be positioned in areas which are liable to freezing.

AAVs require a free movement of air around them which can be achieved by ventilation grilles, discreet gaps around the boxing or ventilation of the boxing into a ventilated roof void. The ventilation area should be not less than 2500mm² unless otherwise specified by the manufacturer.

TESTING AND COMMISSIONING

8.1 - S9 All services shall be tested

Testing should be carried out in accordance with all relevant regulations and codes of practice.

Pipes to be located under screeds should be air or water tested both before and after the screed is laid.

Leaks or other defects should be made good prior to the application of finishes.

Before completion and handover of the building services should be commissioned in accordance with relevant regulations and codes of practice.

APPENDIX 8.1-A

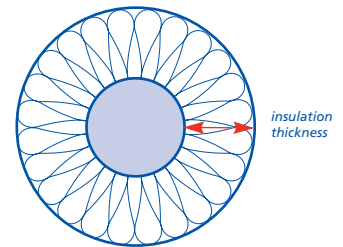
Thermal insulation of water pipes to delay freezing

Minimum insulation thickness (mm) needed to delay freezing inside domestic premises for cold water systems.				
Outside pipe diameter (mm)	Thermal conductivity of material at 0°C W/(m-K)			
	0.025	0.030	0.035	0.040
15	30	45	70	91
22-28	12	15	19	24

Notes:
The conditions assumed for the table are:

- air temperature -6°C
- water temperature +7°C
- ice formation 50%

Examples of insulating materials	
Thermal conductivity W/(m-K)	Material
Less than 0.020	Rigid phenolic foam
0.020 to 0.025	Polyisocyanurate form and rigid polyurethane foam
0.025 to 0.030	PVC foam
0.030 to 0.035	Expanded polystyrene, extruded polystyrene, cross-linked polyethylene foam, expanded nitrile rubber and improved polyethylene foam
0.035 to 0.040	Standard polyethylene foam, expanded synthetic rubber and cellular glass



See table above for minimum thickness of insulation

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