Chapter

8.1

Internal services

This chapter gives guidance on meeting the Technical Requirements for internal services, including:

- **the supply of hot and cold water services**
- **vented and unvented hot water storage systems**
- **plumbing**
- **gas services**
- **electrical installations.**

Figure reference table

Figure Reference Table 8.1			
Fig No	**Title/Description**	**Clause**	**Page**
Figure 1	Protection from the cold — loft space	8.1.3.4	4
Figure 2	Protection from the cold — header tanks	8.1.3.4	4
Figure 3	Pipe insulation thickness	8.1.3.4	4
Figure 4	Underfloor water supply pipe insulation	8.1.3.4	4
Figure 5	Masonry brick and block plastered	8.1.5.1	6
Figure 6	Dry lined walls on batons	8.1.5.1	6
Figure 7	Dry lined walls on dabs	8.1.5.1	6
Figure 8	Timber frame or light steel construction wall	8.1.5.1	6
Figure 9	Installed in a timber frame or light steel construction wall	8.1.5.1	6
Figure 10	Safe location of cables	8.1.6.3	8
Figure 11	Notice examples	8.1.6.4	9
Figure 12	Horizontal distance of electrical items to sinks (not bathrooms)	8.1.6.4	9
Figure 13	Horizontal distance of electrical items to hobs	8.1.6.7	10
Figure 14	Cavity tray with inset meter box	8.1.7.2	12
Figure 15	Weephole position with inset meter box	8.1.7.2	12
Figure 16	Low-level unvented discharge — trapped gully	8.1.9.3	15
Figure 17	Low-level unvented discharge — path or garden area	8.1.9.3	15
Figure 17a	Low-level unvented discharge — path or garden area	8.1.9.3	15
Figure 18	Unvented discharge — soil stack	8.1.9.5	16
Figure 19	Air admittance valves	8.1.10.2	17
Figure 20	Sound insulation to soil and vent pipe	8.1.10.3	17

Definitions for this chapter

Mixing (Table 8)	Relates to the cooling effect when incoming cold water mixes with the hot water storage volume, cooling the tank contents, reducing performance and wasting energy.
Stratification (Table 8)	Relates to the tank volume not being cooled by the introduction of cold water when running the hot volume off.
Thermostatic mixing valve (TMV)	A valve that allows the 60°C water leaving the storage cylinder to be blended with cold mains water to achieve the designed temperature.
Wholesome water	Fit to use for drinking, cooking, food preparation or washing without any potential danger to human health.

8.1.1 Compliance

Also see: Chapter 2.1

Incoming utilities shall comply with the Technical Requirements and take account of service entries, ground hazards and chemical attack.

Internal services which comply with the guidance in this chapter will generally be acceptable.

Adequate precautions against ground hazards and the entry of gas ie, radon or gas, from landfill sites should be provided as necessary. Further guidance can be found in BRE Report 211 Radon: Guidance on protective measures for new dwellings (including supplementary advice for extensions, conversions and refurbishment projects) and BRE Report 212 Construction of new buildings on gas-contaminated land. Also see Chapter 4.1 Land quality — managing ground conditions.

8.1.2 Provision of information

Designs and specifications shall be produced in a clearly understandable format, include all relevant information and be distributed to the appropriate personnel.

Provision of information is important as it allows for energy-efficient use of the building and common methods adopted to prevent overheating.

Clear and fully detailed drawings should be available on site to enable work to be carried out in accordance with the design. Design and specification information should be issued to site supervisors, relevant specialist subcontractors and suppliers, and where used include the following information:

Common information required for all of Part 8:

- fixing schedule
- a full set of current drawings
- indication of which manufacturer and/or installer is responsible for each system and interface
- commissioning schedule
- manufacturers' specifications
- interface details
- on-site testing requirements
- type and spacing of clips and fixings
- type and location of ancillary components, including those used for fire safety and acoustic purposes
- commissioning certificates
- cold water pipe runs
- water efficiency calculations.

8.1.3 Water services and supply

Water services shall be based on the pressures and flow rates supplied from the incoming main. Components shall be selected and installed to ensure satisfactory service for the life of the system, with suitable precautions taken against corrosion and damage. Issues to be taken into account include:

1) **suitability of materials and components**
2) **adequate supply**
3) **durability**
4) **protection from the cold**
5) **wholesome water**
6) **water efficiency.**

8.1.3.1 Suitability of materials and components

Relevant standards for materials and components used in domestic water systems include:

BS EN 806	Specifications for installations inside buildings conveying water for human consumption
BS EN 12897	Water supply. Specification for indirectly heated unvented (closed) storage water heaters
BS EN 1057	Copper and copper alloys. Seamless, round copper tubes 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 pipe and fitting systems for hot and cold water for domestic purposes and heating installations in buildings
BS 8558	Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806

8.1.3.2 Adequate supply

The design and installation of the water services supply should:

- be in accordance with relevant Building Regulations, statutory requirements and the recommendations of the water supplier
- ensure drinking water is provided at the kitchen sink direct from the supply pipe or, where this is impracticable, from a storage cistern containing an adequate supply of drinking water
- be based on a minimum 1.5 bar dynamic pressure at the stop valve inside the home
- ensure a minimum of 20L/min flow rate is available at the stop valve inside the home
- account for pressure and flow rate reductions (a wider supply pipe may be required inside the home)
- account for pressure fluctuations and surges, which may occur within the system and potentially damage fittings (surge arresters may be required)
- ensure that stop valves within the curtilage and outside the home are protected by a shaft or box
- ensure that service pipes are a minimum of 750mm below the ground surface — where this is not possible, adequate precautions should be taken against frost and mechanical damage
- ensure that underground ducts are sealed at both ends to prevent the entry of fluids, vermin and insects
- be of materials which are safe and minimise the risk of corrosion
- be in accordance with the recommendations of the water supplier, including compatibility of the supply with the materials and fittings
- ensure that the water system is capable of being drained (hot and cold services separately).

8.1.3.3 Durability

The hot and cold water service should be installed using corrosion-resistant pipes 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. Sacrificial anodes should be installed where required by the water supplier.

8.1.3.4 Protection from the cold

Also see: Clause 7.2.15

To reduce the risk of freezing, or condensation forming on the pipework, water services should be located in the warm envelope of the home. Where possible, water pipes should be below the main roof insulation.

Particular care is needed with cisterns, vent pipes, bends and junctions, especially near openings to the outside air, such as eaves.

Where they are located in unheated spaces, they should be insulated and not affected by cold. Insulation should be provided:

- around water services, including pipework (in accordance with Tables 1 and 2)
- as specified in the design (but not beneath a cold water tank)
- on each side of raised tanks in unheated roof spaces
- even where it is below the main roof insulation (see Figure 1, 2 and 3)
- in accordance with BS EN 806 and BS 8558.

Figure 1: Protection from the cold — loft space

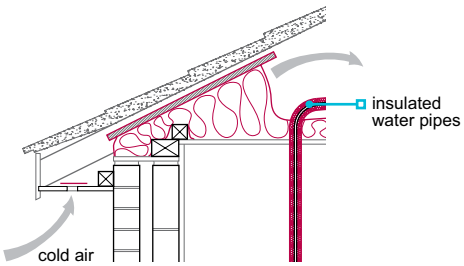


Figure 2: Protection from the cold — header tanks

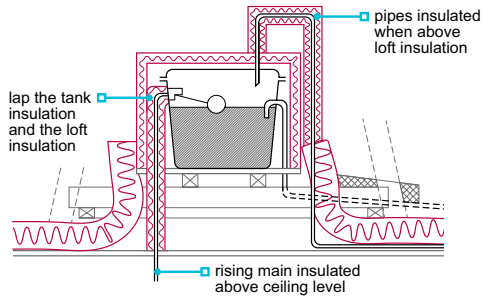


Figure 3: Pipe insulation thickness

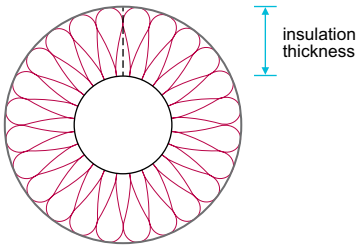


Table 1: Minimum insulation thickness to delay freezing inside domestic premises for cold water systems taken from BS 5422:2009 Table 30 (see Figure 3).

Outside diameter (mm)	Thermal conductivity at 0°C W/(m.K)			
	0.025	0.035	0.045	0.055
	Thickness of thermal insulation (mm)			
15	30	62	124	241
22	12	20	30	43
28	8	12	17	23

The conditions assumed for the table are:

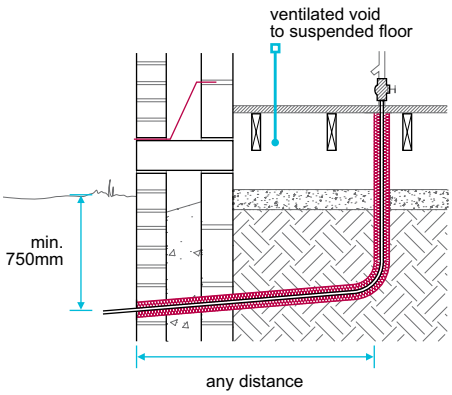
- air temperature -6°C
- water temperature +7°C
- permitted ice formation 50%
- evaluation period 12 hours
- installation inside the building
- for practical reasons, if the pipe and insulation diameter are too large to be applied in practice, insulation with a lower thermal conductivity should be used.

Table 2: Examples of insulating materials:

Thermal conductivity W/(m.K)	Material
Less than 0.020	Rigid phenolic foam
0.021 to 0.035	Polyurethane foam
0.040 to 0.055	Corkboard
0.055 to 0.07	Exfoliated vermiculite (loose fill)

Where the floor is of suspended construction, the underfloor water service should be insulated as it passes through the ground and the ventilated space (see Figure 4).

Figure 4: Underfloor water supply pipe insulation



8.1.3.5 Wholesome water

There must be suitable installation for the provision of wholesome water to any place where drinking water is drawn off.

8.1.3.6 Water efficiency

Water efficiency should be accounted for in any design to prevent waste and undue consumption.

This can either be by a fittings approach or a water efficiency calculator or other approved method acceptable to NHBC.

8.1.4 Cold water storage

Cold water storage shall be provided in accordance with statutory requirements and be adequate. Issues to be taken into account include:

1) **cold water storage**
2) **cisterns**
3) **cistern support**
4) **warning and overflow pipes**
5) **access.**

8.1.4.1 Cold water storage

Cold water storage should be provided with suitable capacity and include primary feed cisterns where indirect water heating systems are installed. Cold water storage should be provided:

- to supply an open vented hot water storage system (where required by the water supplier)
- to supply cold water outlets (where not connected to the mains supply)
- to prevent undue consumption, contamination and water wastage.

8.1.4.2 Cisterns

Cisterns should:

- be accessible for inspection and maintenance
- be protected by a rigid close-fitting cover (non-airtight) that also excludes light and insects
- have holes neatly formed with a cutter in the positions shown in the design
- be suitably supported.

8.1.4.3 Cistern support

The cistern bottom should be continuously supported by materials such as:

- softwood boarding
- plywood to BS EN 636-2s
- chipboard type P5 to BS EN 312
- oriented strand board type OSB3 to BS EN 300, laid with the stronger axis (as marked on board) at right angles to the bearers.

8.1.4.4 Warning and overflow pipes

Warning and overflow pipes should:

- be provided at each cold water cistern, to a suitable external discharge, unless permitted by water regulations where it may be internal if it is conspicuous
- be adequately sized (19mm internal diameter (ID) minimum)
- be situated 25mm above the shut-off water level in the cistern
- be in accordance with water regulations, terminate vertically downwards or be fitted with a horizontal tee where it discharges (and may dip below the water level where permitted by the water regulations).

8.1.4.5 Access

Access for cold water storage should be in accordance with Clause 7.2.12.

- be provided to the main roof space and voids that contain cisterns and tanks, etc (not required to roof spaces containing only water pipes).

8.1.5 Gas services

Also see: Chapters 6.2, 6.8, 8.6 and BS 6400 and BS 6891

Gas service installations shall be adequate and comply with the gas safety regulations and be in accordance with relevant standards and codes to ensure safe and satisfactory operation. Gas service installations should take into account:

1) gas service installation

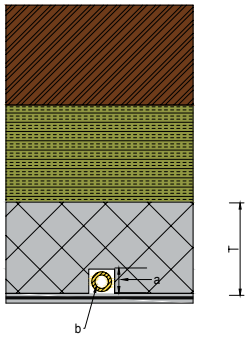
2) corrugated stainless steel tube (CSST).

8.1.5.1 Gas service installations

Gas service installations should ensure:

- service pipework up to and including the emergency control valve and meter is in accordance with the requirements of the gas transporter, gas supplier and primary meter owner
- installation of pipework and appliances complies with relevant standards and codes, including those published by the Institution of Gas Engineers and Managers (IGEM), British Standards Institution (BSI) or Gas Safe Register (GSR)
- where there is a gas supply to the home, a gas point at the cooker space is provided (this is not required where an electric hob is provided)
- where gas pipework is to be installed in timber frame, allowance is made for differential movement
- installation of gas pipes will not impair the structural stability, fire/smoke resistance, damp proof course, radon barrier, hazardous ground membrane, thermal or sound insulation of the building
- gas installation pipes are not over bent, stressed or installed where subject to mechanical damage (see Figures 5-9).

Figure 5: Masonry brick and block plastered



a. depth of chase

b. pipework set into chase in plastered wall

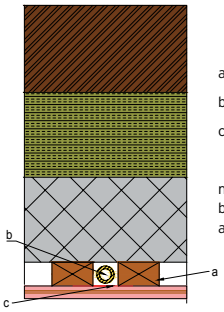
maximum depth of chase

T/6 horizontal

T/3 vertical

Figure 6: Dry lined walls on batons

CSST pipes installed behind dry lining shall be encased by building material



a. continuous timber battens

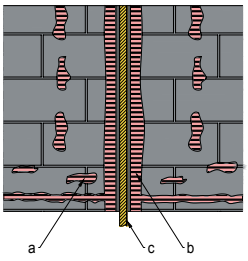
b. gas pipework

c. steel plate to 1mm thick

note the joints between the wall and the studs must be sealed with a suitable mastic to avoid gas tracking around the wooden studs.

Figure 7: Dry lined walls on dabs

CSST pipes installed behind dry lining shall be encased by building material

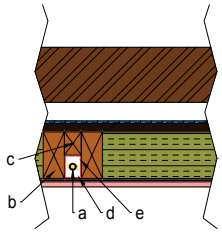


a. individual adhesive dabs

b. continuous adhesive dabs surround gas pipe

c. gas pipe

Figure 8: Timber frame or light steel construction wall



a. gas pipework

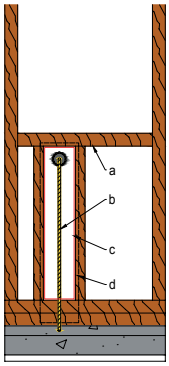
b. timber stud

c. timber stud blocking piece

d. steel plate to 1mm thick

e. joints sealed with suitable mastic to avoid escaping gas tracking around wooden struts

Figure 9: Installed in a timber frame or light steel construction wall



a. timber stud

b. gas pipe

c. steel plate to 1mm thick

d. joints sealed with suitable mastic to avoid escaping gas tracking around wooden struts

8.1.5.2 Corrugated Stainless Steel Tube (CSST)

Gas pipe installations Incorporating CSST should:

- conform to the CSST benchmark scheme with secondary cover for use as a secondary containment or BSI PP1644 flexible ventilated ducting for corrugated stainless steel tubing
- be certified by a UKAS accredited independent technical approval authority and tested in accordance with BS EN ISO 13823 and BS EN ISO 11925-2 and classified in accordance with BS EN 13501-1 and achieve B-s1, d0 or better
- be adequately supported in line with manufacturers' recommendations
- not be mixed with other proprietary brands of CSST or fittings
- not be buried in concrete floors, unless it is appropriate for the application, and the manufacturer confirms it is suitable for this purpose.

CSST without ducting shall meet the "tightness in case of fire requirements" of BS EN 15266, test method BS EN 1775 Annex A procedure A.

Where any pipe ducting is used that is intended to be fire resistant, it should be at least the same level of fire resistance as the protected area it is installed in. The fire resistance of the ducting shall be tested, evaluated and fire rated to the relevant parts of BS 476-24.

8.1.6 Electrical services

Also see: Chapter 8.6

Electrical installations shall be provided in accordance with relevant regulations, codes and standards. The installation shall ensure safe and satisfactory operation, and be protected from chemical attack.

Items to be taken into account include:

1) installation
2) provision of sockets
3) cable positions
4) consumer units
5) fire rated partitions
6) lighting outlets
7) cooking spaces
8) built-in appliances
9) metal splashbacks
10) electrical supply to gas appliances
11) TV
12) smoke and heat alarms
13) electric vehicle charging points
14) electronic communications
15) lightning protection.

8.1.6.1 Installation

Electrical services and installations should:

- comply with BS 7671 Requirements for electrical installations
- comply with BS 6004 Electric cables. PVC insulated and PVC sheathed cables for voltages up to and including 300/500 V, for electric power and lighting
- have fittings and components located in accordance with relevant Building Regulations
- be installed in accordance with the manufacturer's recommendations
- ensure cables are not placed under, against or within thermal insulation, unless they have been appropriately sized and derated
- ensure PVC covered cables are not in contact with polystyrene insulation
- be provided with a completion certificate by the electrical contractor to the builder (covering all aspects of the installation, including earth bonding)
- incorporate appropriate automatic devices for protection against overcurrent or leakage. Where electrical items contain electronic components or create a Direct Current (DC) waveform in an Alternating Current (AC) supply, the Residual Current Device (RCD) should be a suitable type to prevent nuisance tripping, eg heat pumps, solar photovoltaic, micro wind, electric vehicle charging points, circulating pumps or induction hobs, USB charging sockets
- be supported such that they will not be liable to premature collapse in the event of a fire where hanging across access or egress routes. This can be achieved by using steel containment systems (either in or on) and precludes the use of non-metallic cable clips or ties as the sole means of support where cables are clipped direct to exposed surfaces. Suitably placed steel or copper clips, or saddles would be acceptable. (Plastic wall plugs with a steel clip will be acceptable if suitably sized for the screw and load)

- be earthed, where electrical sockets, fused spurs or light switches use metal back boxes that are fully recessed and covered by the faceplate. The earth terminal on the sockets should be used to connect the earth wire to. If no earth terminal is provided, as in the case of a light switch, the metal back box requires earthing
- not leave exposed wiring for homeowners to connect their own electrical fittings after occupation. All cables should terminate in a suitable proprietary electrical enclosure complying with the appropriate British Standard such as a recessed back box with cover or a temporary light fitting, for example a batten lamp holder
- be sited to provide reasonable access to homeowners.

8.1.6.2 Provision of sockets

Rooms should be provided with the minimum number of 13A outlets listed in Table 3 (dual outlets count as two).

Table 3: Minimum number of outlets

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

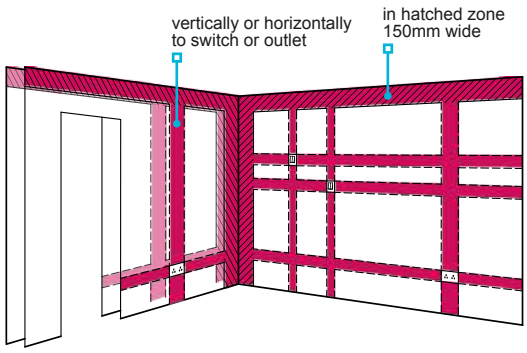
8.1.6.3 Cable positions

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

- vertically or horizontally from the outlet or switch being served
- within the shaded zone in the diagram (see Figure 10), or
- a minimum of 50mm from the surface of a wall, or a minimum of 50mm from the top or bottom of a timber joist or batten in a floor or ceiling.

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 applies to the reverse side.

Figure 10: Safe location of cables



8.1.6.4 Consumer units

Consumer units should:

- have their enclosure manufactured from non-combustible material or be enclosed in a cabinet or enclosure constructed of non-combustible material (ferrous metal, eg steel, is deemed to be an example of non-combustible material)
- be compliant with BS EN IEC 61439-3 and, where installed for use by ordinary persons have an IP2XC rating
- not have any gaps between blanking pieces and circuit breakers larger than IP2XC requirement (hazardous parts within the enclosure cannot be contacted by a wire probe 2.5mm diameter and 100mm long)
- provide space for the installation and subsequent repair or replacement in line with manufacturers' recommendations
- be labelled such that each circuit protected by a fuse or circuit breaker can easily be identified.

Where labels/notices are not provided, the Electrical Installation Certificate, complete with guidance for recipients as detailed in Appendix 6 of the IET Wiring Regulations should be made available for inspection on site.

Where labels/notices are fitted, they should be fixed in a permanent position at or near the origin of every installation. The most convenient location for these notices is usually on the consumer unit. Any notice should be of a durable material and indelibly marked (see Figure 11).

Figure 11: Notice examples

For periodic inspection and testing the label shall read as follows:

Important

This installation should be periodically inspected and tested and a report on its condition obtained, as prescribed in BS 7671 Requirements for Electrical Installations

Date of last inspection.....

Recommended date of next inspection.....

Where RCDs are provided, a label shall read as follows:

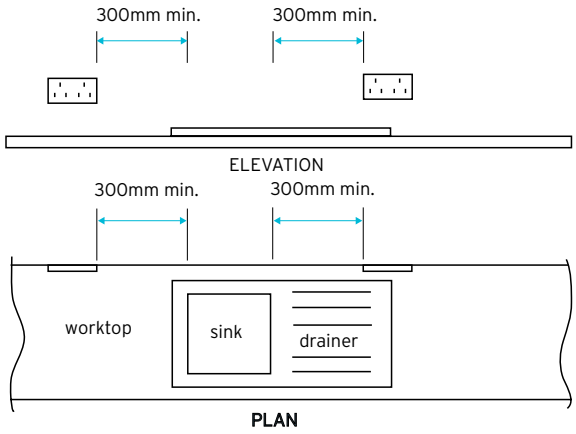
Important

This installation, or part of it, is protected by a device which automatically switches off the supply if a fault develops. Test six-monthly by pressing the relevant test button(s) which should operate the device. Afterwards, manually switch on the device. If the device does not operate, or indicates a fault, seek expert advice.

- where multiple rows of consumer units are utilised BEAMA recommends the bottom row of switches are located at a height of between 1,350mm - 1,450mm
- electrical equipment installed in a bathroom, should be suitable for the environment and be within the correct electrical zones in accordance with BS 7671.

Where installed in other locations (not bathrooms/ensuites) Have a minimum separation of 300mm measured horizontally to the edge of any bowl of a sink or wash basin opening to avoid splashing from the sink or basin. General guidance is to avoid positioning electrical equipment immediately above or alongside a sink and, where space exists, an accessory should be located beyond the drainer (see Figure 12).

Figure 12: Horizontal distance of electrical items to sinks (not bathrooms)



8.1.6.5 Fire rated partitions

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

8.1.6.6 Lighting outlets

Lighting outlets should be provided:

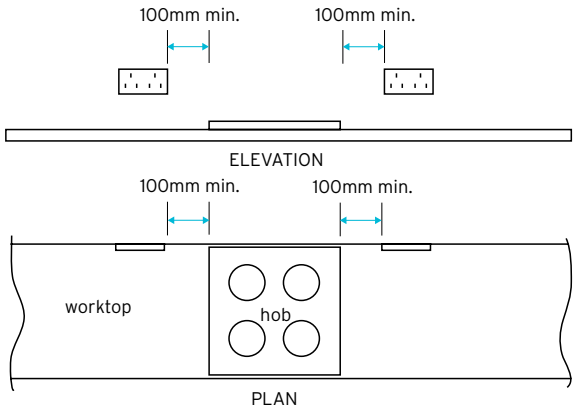
- in each room, hall, landing and staircase
- with two-way switching at each floor level in a staircase
- in the common areas of homes and controlled by either manual switching or automatic light-sensitive controls.

8.1.6.7 Cooking spaces

Cooking spaces should:

- have a minimum 30A supply which is suitably switched and terminated
- have a 13A socket outlet where there is a gas supply
- where provided, have cooker panels located to the side of the cooker space
- have a minimum of 100mm measured horizontally from an electrical accessory to the edge of a freestanding cooker or individual hob (see Figure 13).

Figure 13: Horizontal distance of electrical items to hobs



8.1.6.8 Built-in appliances

Where appliances are built in:

- isolation should be reasonably accessible and in compliance with the manufacturer's recommendations
- disconnection points should always be local to the appliance to enable isolation without affecting the use of other electrical appliances or equipment in the same circuit
- disconnection should not require the removal of the appliance from its housing to access and operate.

8.1.6.9 Metal splashbacks

The Institute of Electrical Engineers has confirmed that earth bonding is not required to metal splashbacks in kitchens, including those splashbacks containing electrical accessories such as socket outlets.

8.1.6.10 Electrical supply to gas appliances

Also see: Clause: 8.3.2.7

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

8.1.6.11 TV

Aerials are not required; however, one of the following should be provided:

- a concealed, coaxial cable from the roof void to a terminal outlet in the main living room
- a conduit and draw wire or suitable alternative.

8.1.6.12 Smoke and heat alarms

Smoke and heat alarms should be provided in accordance with relevant Building Regulations.

Where additional measures are required by the design the following consideration should be taken into account and have a mains power supply from either:

- an independent circuit with no other electrical equipment connected other than a dedicated social alarm control unit or a mains-powered carbon monoxide (CO) alarm interlinked, if the manufacturer's instructions allow this
- a separately electrically protected regularly used lighting circuit, in which case, there should be a means of isolating the smoke alarm from the lighting circuit for maintenance.

If more than one smoke alarm is interconnected, they should all be isolated by one single circuit (unless the interconnection is via remote communication).

Where used, smoke alarms should be labelled appropriately to prevent the device being inadvertently disconnected. Labels should be:

- provided to any isolator stating, "smoke alarm is fitted, do not switch off"
- provided to any lighting circuit isolator stating, "caution, smoke alarms connected to this circuit, do not switch off".

8.1.6.13 Electric vehicle charging points

Where electric vehicle charging points are installed, consideration should be given to:

- Technical Requirements
- product certification
- operative competency
- manufacturers' instructions
- location to not cause hazard or nuisance
- serviceability.

8.1.6.14 Electronic communications

Where electronic communications are installed, consideration should be given to:

- Technical Requirements
- distribution point
- common access point
- public electronic communications networks.

8.1.6.15 Lightning protection

Lightning protection, where used, should comply with the relevant standards and be appropriate for the location installed:

BS EN 62305-1-5	Protection against lightning
PD 62305-2:2014	Flash density map 2014. Supplement to BS EN 62305-2:2012. Protection against lightning. Risk management
BS EN IEC 62561-1	Lightning protection system components
BS EN IEC 62561-2	Lightning protection system components
IEC 60068-2-52	Environmental testing: salt mist, cyclic (sodium chloride solution)
IEC ISO 6957	Copper alloys: ammonia tests for stress corrosion resistance
ISO 22479	Corrosion of metals and alloys — sulfur dioxide test in a humid atmosphere

8.1.7 Meter boxes

Also see: Clause: 6.1.17

Openings in walls for meter cabinets shall be structurally adequate and prevent dampness entering the home.

Meter boxes and associated equipment should be located to be reasonably accessible and not subject to damage; guidance should be sought from the appropriate Gas Distribution Network Operator (GDNO) and/or Distribution Network Operator (DNO) for electrical installations. Issues to take into account include:

1) domestic meter boxes

2) openings.

8.1.7.1 Domestic meter boxes

Domestic meter boxes may be of the following type:

- built-in (to the outer leaf of the wall)
- surface-mounted (on an external wall).

Incoming supply to the meter box should be in accordance with the service provider's requirements.

8.1.7.2 Openings

Openings set into external walls should be:

- provided with DPCs and cavity trays (see Clause 6.1.17 for further guidance and Figure 14)
- provided with lintels (except for purpose-designed, built-in meter boxes)
- provided with insulation carried past meter box to avoid cold bridging (any reduction in thickness to be accounted for in the thermal assessment of dwelling)
- have weephole positions/openings located in a perp joint (see Figure 15)
- installed in accordance with DNO and/or GDNO with relation to ventilation openings.

Figure 14: Cavity tray with inset meter box

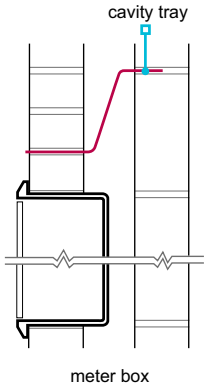
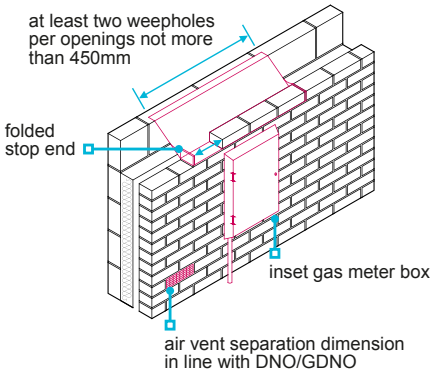


Figure 15: Weephole position with inset meter box



8.1.8 Hot water services

Also see: Chapter 8.6 and BS 8558

Hot water services shall be provided in accordance with statutory requirements and be adequate for the demand and consumption. Issues to be taken into account include:

1) **design**
2) **location**
3) **immersion heaters**
4) **vented storage cylinders.**

8.1.8.1 Design

Hot water services should be designed in accordance with Tables 4, 5 and 6, and:

- the minimum flow rate should be in accordance with the statutory requirements and generally be available; it may be less where the pressure and flow rate of the incoming supply falls below 1.5 bar
- have the design flow rate available at each outlet when the total demand does not exceed 0.3L/sec (where simultaneous discharge occurs, the flow rate at individual outlets should not be less than the minimum rate).

Table 4: Flow rate and temperature requirements

Outlet	Design flow rate(1)		Minimum flow rate(2)		Supply temperature °C(3)
	L/sec	(L/min)	L/sec	(L/min)	
Bath (from storage)	0.30	(18)	0.15	(9)	48
Bath (from combi)	0.20	(12)	0.15	(9)	40
Shower (non-electric)	0.20	(12)	0.10	(6)	40
Wash basin	0.15	(9)	0.10	(6)	40
Sink	0.20	(12)	0.10	(6)	50

Notes

1. The design flow rate should be used to establish the hot and cold pipe sizes to provide the flow rate quoted at each outlet when that outlet is used on its own.
2. The minimum flow rate should be available at each fitting when that fitting is used simultaneously with one or more other fitting(s) as shown in Table 5.
3. The supply temperature is the temperature at the outlet. In accordance with BS 8558, the water temperature at an outlet or thermostatic mixing valve should be at least 50°C within one minute of running the water.

Table 5: Hot water demand and simultaneous use

Bathroom		Shower room		Hot water demand[5]	
Bath only	Bath + shower[1]	1st shower room	2nd shower room	L/sec	(L/min)
✓ [2]				0.20	12
		✓ [3]		0.15	9
✓		✓		0.25	15
✓		✓	✓	0.35	21
	✓ [2]			0.20	12
	✓ [4]	✓		0.20	12
	✓ [4]	✓	✓	0.30	18
		✓	✓	0.20	12

Notes

1. Shower may be over the bath or in a separate enclosure within the bathroom.
2. Demand based on 'design' flow rate of bath.
3. Demand based on minimum acceptable boiler output.
4. Demand based on use of the shower in preference to the bath.
5. The hot water system should supply at least the hot water demand stated and take account of distribution heat losses through the pipework. The suitability of instantaneous systems (combination boilers) will be limited by their performance as quoted by the boiler manufacturer.

Hot water storage should comply with the minimum capacity in Table 6 (based on a draw-off temperature of 60°C), and where appliances require greater volumes, the capacity should be increased accordingly.

The volumes shown in Table 6 are calculated using Annex B BS 8558. Volumes have been rounded to common cylinder volumes available.

Table 6: Minimum storage requirements

	Heat input to water at 60°C					
Usage example	3kW	6kW	10kW	15kW	20kW	Cylinder type
One shower (smaller dwelling)	60L	60L	60L	60L	60L	With stratification
One shower (smaller dwelling)	90L	90L	90L	90L	90L	With mixing
One bath (small dwelling)	120L	100L	90L	90L	90L	With stratification
One bath (small dwelling)	150L	100L	90L	90L	90L	With mixing
One bath + separate shower (larger dwelling)	165L	140L	130L	120L	120L	With stratification
One bath + separate shower (larger dwelling)	260L	210L	130L	130L	130L	With mixing
Two baths (larger dwelling)	165L	140L	130L	120L	120L	With stratification
Two baths (larger dwelling)	260L	210L	130L	130L	130L	With mixing

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

Where homes have one bathroom or shower room, the system should be able to provide adequate hot water:

- immediately after the bath has been filled, for tasks such as washing
- for a second bath after 30 minutes.

Where homes have two or more bathrooms, the system should be able to provide adequate hot water immediately after each of the baths have been filled, for tasks such as washing.

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

Instantaneous systems (using combination boilers) produce hot water on demand (generally at lower flow rates than storage systems) and should only be used where:

- simultaneous demand for hot water is limited. Where there are three or more outlets, the design for simultaneous discharge can omit the outlet at the kitchen sink
- storage combination boilers have the capacity as required in Table 6. Where boilers can control and prioritise hot water outputs the storage capacities can be less than the figures in Table 6 subject to manufacturers' recommendations on meeting the demand.

8.1.8.2 Location

Storage systems weight will vary by size of storage demand designed; the installation should be:

- a suitable space for the siting of the storage vessel to allow for installation
- supported in accordance with the manufacturer's recommendations
- installed vertically, unless designed otherwise
- accessible for maintenance, service, repair and replacement
- insulated as specified in the design.

8.1.8.3 Immersion heaters

Where an immersion heater is fitted, it should be:

- appropriate for the type of water supplied to the home
- controlled by a thermostat
- located to facilitate replacement
- supplied with an energy cut-out device to prevent overheating
- suitable for the water quality on-site
- fitted with an on/off switch.

8.1.8.4 Vented storage systems

Vented storage systems should be provided with a correctly sized expansion pipe that terminates into a correctly designed, supported and insulated supply tank.

8.1.9 Unvented storage systems

Unvented storage systems and discharge pipework shall be in accordance with relevant regulations. Be securely fixed and any discharge pipes terminate in a safe visible position. Issues to be taken into account include:

1) **product certification**
2) **discharge pipework**
3) **low-level discharge**
4) **high-level discharge**
5) **discharge pipework material.**

8.1.9.1 Product certification

Unvented hot water storage systems should be:

- assessed in accordance with Technical Requirement R3, or meet the requirements of BS EN 12897 and be the subject of third-party certification (applies to both the assembled system and components)
- installed by competent installers.

8.1.9.2 Unvented storage system discharge pipework

Discharge pipework should:

- terminate in a safe and visible position
- have the tundish as close to the storage system as possible in a visible position
- not be connected to other waste connections
- not terminate inside garages
- be sized appropriately in line with national standards
- be adequately supported
- be installed with a fall to outside in line with the manufacturer's recommendations.

8.1.9.3 Low-level discharge

Low-level discharge should be either:

- into a trapped gully below the grating but above the water level (see Figure 16)
- onto the ground (drive, path or garden area) the pipe should discharge downwards and be a maximum of 100mm above ground level. The discharge should be protected from being touched before it has hit the ground. This is normally achieved by installing a cage over the pipe at the point of discharge (see Figure 17 and 17a).

Figure 16: Low-level unvented discharge — trapped gully

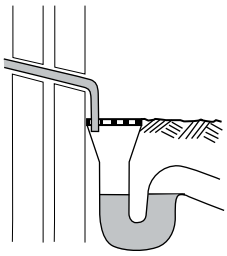


Figure 17: Low-level unvented discharge — path or garden area

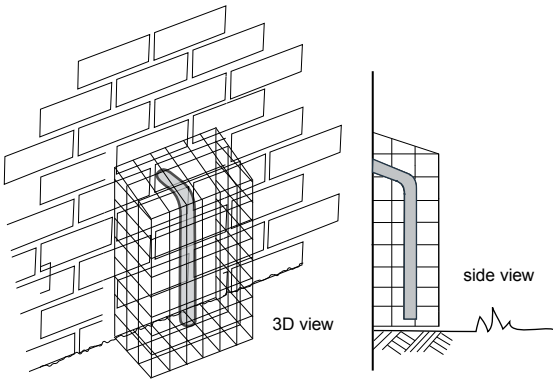
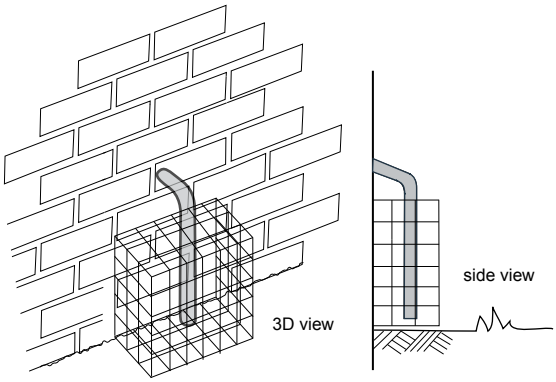


Figure 17a: Low-level unvented discharge — path or garden area



8.1.9.4 High-level discharge

High-level discharge is only acceptable when:

- it terminates onto a flat or pitched roof capable of withstanding water at high temperature
- the termination is 3m away from plastic guttering
- terminating into a metal hopper head and downpipe which in turn terminates safely and discharge at low level.

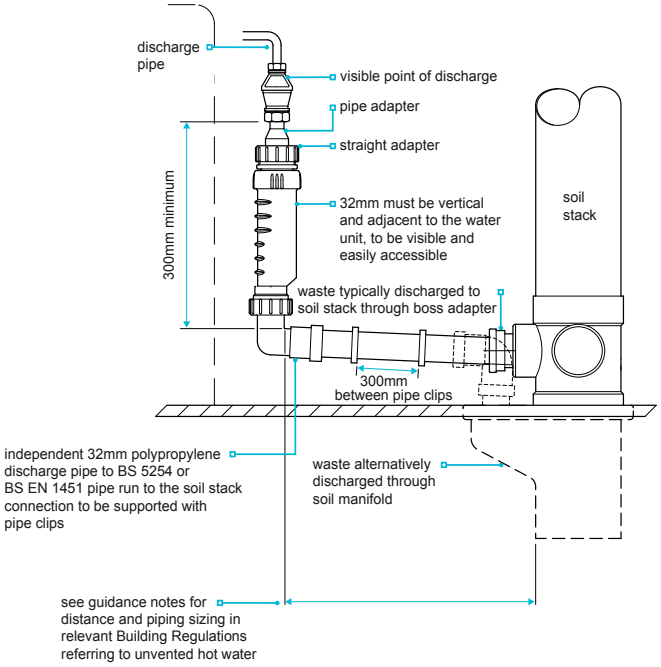
8.1.9.5 Discharge pipework material

The normal material for discharge pipework is metal.

When thermoplastic pipes or fittings or similar equipment is used, compliance with R3 is required. They should have a satisfactory assessment by an appropriate independent technical approvals' authority accepted by NHBC.

Waterless traps and waste pipes should comply with the marking requirements of *BS 7291-1 Thermoplastic pipes and fittings for hot and cold water for domestic purposes* (see Figure 18).

Figure 18: Unvented discharge — soil stack



8.1.10 Internal soil and waste systems

Also see: Clause 6.3.7

Soil and waste systems shall be in accordance with relevant Building Regulations and installed to ensure that effluent is removed without affecting health or creating unnecessary noise and smell. Items to be taken into account include:

1) **relevant standards**
2) **air admittance valves**
3) **sound insulation to soil and vent pipe**
4) **sanitary fittings**
5) **waste disposal**
6) **junctions.**

Soil and waste systems should be:

- in accordance with the requirements of the water supplier
- adequately ventilated at the head of underground drains (this may be by a soil pipe or separate ventilation pipe)
- adequately ventilated at each branch
- arranged to ensure foul air from the drainage system cannot enter homes (eg ventilated to 900mm above openings when within 3m)
- fixed neatly and securely to provide the correct falls
- fitted to prevent the entry of vermin.

8.1.10.1 Relevant standards

Relevant standards for domestic soil and waste systems include:

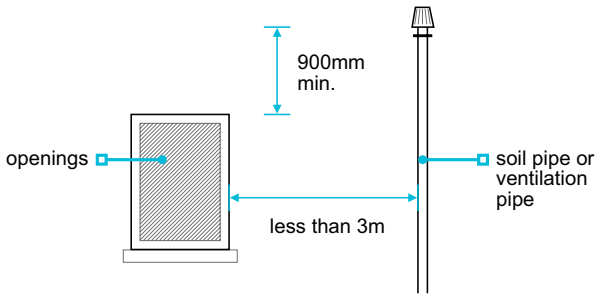
BS EN 752	Drain and sewer systems outside buildings
BS EN 12056-1	Gravity drainage systems inside buildings — General and performance requirements
BS EN 12056-2	Gravity drainage systems inside buildings — Sanitary pipework, layout and calculation
BS EN 12056-3	Gravity drainage systems inside buildings — Roof drainage, layout and calculation
BS EN 12056-4	Gravity drainage systems inside buildings — Wastewater lifting plants. Layout and calculation
BS EN 12056-5	Gravity drainage systems inside buildings — Installation and testing, instructions for operation, maintenance and use

8.1.10.2 Air admittance valves

Air admittance valves should:

- be used to allow air to enter the drainage system (but do not avoid the need to ventilate it adequately)
- comply with BS EN 12380 or be assessed in accordance with Technical Requirement R3 (see Figure 19)
- not be positioned in areas which are liable to freezing
- have 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 2,500mm² minimum unless otherwise specified by the manufacturer — see Figure 19)
- where positioned within the home, be accessible for maintenance.

Figure 19: Air admittance valves



8.1.10.3 Sound insulation to soil and vent pipes

All sections of soil and vent pipe, including those in bathrooms or ground floor stub stacks, should be soundproofed to limit the transmission of noise (see Figure 20).

Sound insulation should be provided to soil pipes passing through homes by:

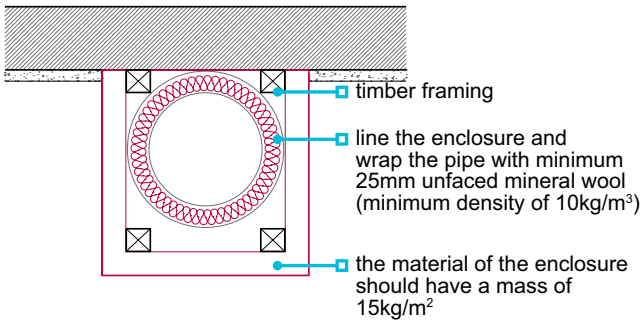
- an encased boxing, using material (15kg/m²) and
- wrapping the pipe with a minimum 25mm of unfaced mineral wool (10kg/m³ minimum — the insulation should be continued through the thickness of each sound-insulating floor).

Where soil and vent pipes run horizontally through a floor void above or below a habitable room, they should be:

- wrapped in at least 25mm of mineral wool (10kg/m³ min)
- adequately supported to avoid contact with the floor decking or ceiling.

Soil and vent pipes which hold a satisfactory assessment by an appropriate independent technical approvals' authority acceptable to NHBC may be acceptable where the requirements of the relevant Building Regulations are achieved.

Figure 20: Sound insulation to soil and vent pipes



8.1.10.4 Sanitary fittings

Sanitary fittings should be:

- installed with accessories, such as chains and plugs
- secured using non-ferrous or stainless steel screws or fixings appropriate to the weight of item being secured
- fitted without using excessive packing
- fitted to ensure WC lids and seats are stable when open.

8.1.10.5 Waste disposal

Waste disposal units should be:

- provided with adequate support
- fitted with a tubular trap (not bottle or resealing)
- connected to the drainage system in accordance with the manufacturer's recommendations.

8.1.10.6 Junctions

The junctions of wall tiling with baths and showers should be made watertight using a flexible sealant to accommodate movement. The manufacturer's instructions should be followed.

8.1.11 Further information

- *BS 6400 Specification for installation, exchange, relocation, maintenance and removal of gas meters*
- *BS 6891 Specification for the installation and maintenance of low pressure gas installation pipework of up to 35mm*

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