Chapter 1
General considerations

1.1 Scope of the standard

This book is based primarily on BS 6700 but also contains information from other standards and regulations. BS 6700:2006 is a revision of BS 6700:1997. It specifies requirements and gives recommendations for the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. It covers systems in domestic and non-domestic buildings for the supply of water for drinking and culinary use, domestic laundry, ablutionary, cleansing and sanitary purposes.

The following are not included although, in parts, the standard may apply to them: hot water systems whose temperature exceeds 100°C; central heating systems; firefighting; and water for industrial purposes. However, because hot water is increasingly linked with central heating, and aspects of fire protection are included in Building Regulations, these subjects have been taken into account in this book.

BS 6700 does not give detailed specifications for the design and installation of large-scale systems below ground. These come within the scope of BS EN 805 Water supply – Requirements for systems and components outside buildings.

It is expected that BS 6700 will eventually be replaced by BS EN 806 Specification for installations inside buildings conveying water for human consumption. This European standard will be in five parts but, at the time of writing, only parts 1, 2 and 3 have been published.

Note on the scope of BS EN 805

BS EN 805 specifies general requirements for water supply systems and their components outside buildings (see figure 1.1). It includes specifications for the design, installation and testing of potable water mains and service pipes, service reservoirs and other facilities, but excludes treatment works and water resources development. The requirements of BS EN 805 are applicable to:

- all water installations within the supply system outside buildings, irrespective of ownership or responsibility for pipes or other apparatus;
- the design and construction of new water supply systems; and
- significant extension, modification and/or rehabilitation of existing water supply systems.

It is not intended that existing water supply systems be altered to comply with this standard, provided that there are no significant detrimental effects on water quantity, security, reliability and adequacy of the supply.

This book takes into account the requirements of BS EN 805 in respect of water systems outside buildings but is concerned only with supply pipes within premises that are not the responsibility of the water supplier.
1.2 Water Regulations

In England and Wales, water supply was for many years governed by water byelaws, made by water undertakers under Section 17 of the Water Act 1945. Byelaws have now been replaced by the Water Supply (Water Fittings) Regulations 1999 for the prevention of waste, misuse, undue consumption, contamination or erroneous measurement of water supplied by a water undertaker.

Made by the Secretary of State for the Department of the Environment, and the Secretary of State for Wales, the Water Fittings Regulations came into force on 1 July 1999 and apply to any water fitting in premises to which water is supplied by a water undertaker.

Water Fittings Regulations, applicable to England and Wales, are made under Sections 74, 84 and 213 of the Water Industry Act 1991. The requirements are similar in content to the previous byelaws, but have been amended to take account of the latest technical advancement and innovation. In addition to the 14 regulations, there are two schedules, which set out technical requirements in greater detail. Unlike previous legislation, the Water Fittings Regulations could only be made after consultation, through the European Commission, with other Member States of the European Community. Similar legislation applies to water installations in Scotland and Northern Ireland.

In Scotland, the Scottish Water Byelaws 2004 are made under Section 70 of the Water (Scotland) Act 1980 and came into force on 30 August 2004. In Northern Ireland, Water Regulations are made under Article 40 of the Water and Sewerage Services (Northern Ireland) Order 1973. Legislation in Northern Ireland is being revised to make Water Regulations technically similar to those in the rest of the UK.

A building owner or occupier can demand a supply of water for domestic purposes provided the relevant requirements of the Water Industry Act 1991 have been complied with and the installation satisfies the requirements of the Water Fittings Regulations.
Whilst it is the duty of the water supplier to accede to the owner’s demand, the supplier must also uphold the requirements of the Water Regulations and has the right to refuse connection to the mains of any new installation which is not in compliance with them.

To avoid unnecessary dispute with water undertakers, and perhaps lengthy legal proceedings, it is advisable to consult water undertakers about their regulations at an early stage, and particularly their requirements arising from local water or soil characteristics.

Although there is no legal requirement for a person installing or repairing water services to be suitably qualified, the work should be done in a ‘workmanlike manner’, which means conforming to the regulations and following the recommendations of relevant British or European Standards.

Enforcement of the Water Fittings Regulations is the responsibility of water undertakers for their area of supply. It is a statutory requirement that they are notified in advance of any installation, alteration or disconnection of water fittings. Anyone who carries out work of this kind without the consent of the water undertaker can be prosecuted for an offence against current Water Regulations.

It should be noted that householders also commit an offence under the regulations if they ‘use’ a fitting which does not comply with the regulations. Knowledge of the regulations is therefore desirable for both installer and user.

Particular note should be taken of Regulation 5 which requires notice in writing before commencing work on any of the following:

1. The erection of a building or other structure, not being a pond or swimming pool.
2. The extension or alteration of a water system on any premises other than a house.
3. A material change of use of any premises.
4. The installation of:
   (a) a bath having a capacity, measured to the centre line of overflow, of more than 230 l;
   (b) a bidet with an ascending spray or flexible hose;
   (c) a single shower unit (which may consist of one or more shower heads within a single unit) not being a drench shower installed for reasons of safety or health, connected directly or indirectly to a supply pipe which is of a type specified by the regulator;
   (d) a pump or booster drawing more than 12 l/min, connected directly or indirectly from the supply pipe;
   (e) a unit which incorporates reverse osmosis;
   (f) a water treatment unit which produces a waste discharge or which requires the use of water for regeneration or cleaning;
   (g) a reduced pressure zone valve assembly or other mechanical device for protection against a fluid which is in fluid-risk category 4 or 5;
   (h) a garden watering system unless designed to be used by hand; or
   (i) any water system laid outside a building and either less than 750 mm or more than 1350 mm below ground level.
5. The construction of a pond or swimming pool with a capacity greater than 10 000 l which is designed to be replenished by automatic means and is to be filled with water supplied by a water undertaking.

Under Regulation 7 any person who on summary conviction is found guilty of Water Regulations contraventions is liable to a fine, for each separate offence, not exceeding level three on the standard scale. At the time of writing this means a fine of up to £1000 for each offence. In Scotland the fine is level four on the standard scale.
Water undertakers are encouraged under the Water Fittings Regulations to set up approved contractors’ schemes within their area of supply. The scheme requires approved contractors to certify to the undertaker that water fittings installed are in compliance with the regulations. Approved contractors will be excused from prior notification for some work operations, but by no means all of them. Work which may be self-certified by approved contractors includes:

- the extension or alteration of a water system in premises other than a house (extensions or alterations in houses need not be notified);
- a bidet with an ascending spray or flexible hose;
- an RPZ valve or other mechanical device used to protect against a fluid risk category 4 or 5.

The scheme will be of benefit to consumers who, in any proceedings against them, can show ‘that the work was carried out by, or under the direction of, an approved contractor, and that the contractor certified to them that the water fittings complied with the requirements of the Regulations’.

Measures for water conservation permit the use of dual-flushing cisterns, and include the use of non-siphonic flushing methods for WCs. Maximum WC flushing volumes are 6 l for a single flush and 6 l/4 l for dual-flush cisterns.

A Secretary of State Specification for WC Suite Performance requires extensive testing by manufacturers for all WCs whether they are siphonic or non-siphonic.

Pressure flushing valves are permitted (but not in a house) for use in the flushing of both WCs and urinals which may be connected directly to either a supply pipe or a distributing pipe, but they must have backflow protection fitted.

Backflow protection requirements have been revised. The new regulations introduce, in Schedule 1, five fluid-risk categories (rather than the three under previous byelaws) to bring us into line with European practices. At the same time backflow prevention devices are categorized differently in a new Secretary of State specification.

We have been used to safety devices for unvented hot water heaters for a long time. Thermostatic control and temperature relief valves have, of course, been required by the Building Regulations for a good many years. The Water Fittings Regulations now duplicate this requirement.

In Schedule 2 to Regulation 4(3), Paragraph 18 it says ‘Appropriate vent pipes, temperature control devices and combined temperature pressure relief valves shall be provided to prevent the water temperature within a secondary hot water system from exceeding 100°C’.

Water systems are required under Paragraph 13 of Schedule 2 to be tested, flushed and, where necessary, disinfected before use. This is not new, but more emphasis is given to the need for these important aspects of water installations.

It should be added that the Water Fittings Regulations are not made for the specific protection of people or property, but solely for the prevention of waste, undue consumption, misuse and contamination of water supplied by water undertakers:

‘waste’ means water which flows away unused, e.g. from a dripping tap or hosepipe left running when not in use, or from a leaking pipe.

‘undue consumption’ means water used in excess of what is needed, e.g. full bore tap to wash hands when half or quarter flow will suffice, or automatic flushing cistern that flows even when urinals are not in use (at night).
‘misuse’ means water used for purposes other than that for which it is supplied, e.g. use of garden sprinkler when paying only for domestic use or taking supply from domestic premises for industrial or agricultural use.

‘contamination’ means pollution of water by any means, e.g. by cross connection between public and private supplies or by backflow through backsiphonage.

‘erroneous measurement’ means incorrect meter reading, e.g. connections made which may not be detected by the meter.

**Guidance and approval of water fittings**

Guidance on particular Water Regulation matters may be sought from local water undertakers. Their inspectors are trained in the application of Water Regulations.

The Water Regulations Advisory Scheme (WRAS) has published a guide to the application and interpretation of the Water Fittings Regulations. It contains useful information and background knowledge for those concerned with water services. WRAS also operate a voluntary national scheme for the testing and approval of water fittings. Fittings which pass the Centre’s tests are listed in its publication *Water Fittings and Materials Directory*, together with the names and addresses of manufacturers and any applicable installation requirements. Thus, the connection and use of any listed fitting carry with them virtual certainty of acceptance by water undertakers.

**1.3 Building Regulations**

Building Regulations in England and Wales are made under the Building Act 1984. Their purpose is to control building work for the health and safety of occupants and users of buildings and to conserve energy and power. The responsibility for enforcement of building work under Building Regulations lies with local authorities and their building control officers (building inspectors) or other approved inspectors such as the National House Building Council (NHBC). Local authorities and approved inspectors have powers to inspect work during construction. Any disputes that arise may have to be decided ultimately in a court of law. To contravene Building Regulations is a criminal offence.

It should also be noted that building work generally involves more than one Statutory Instrument and any person undertaking water installations or other works should be aware of the relevant requirements in such statutory or guidance documents as Building Regulations, Water Fittings Regulations, Gas Regulations and Electrical Wiring Regulations.

In Scotland, the Building Standards (Scotland) Regulations are made under the Building (Scotland) Act 1959.

In Northern Ireland, the Building Regulations (Northern Ireland) are made under the Building (Northern Ireland) Order 1979.

Building Regulations include a number of water-related provisions. These are:

- pipes passing through compartment walls and floors (B3);
- sprinkler systems (B4) and buildings fitted with fire mains (B5);
- provision for wash basins with hot and cold water in the vicinity of water closets (WCs), and provision for these to be effectively cleaned (G1);
• provision for baths and showers and the supply of hot and cold water to them (G2);
• requirements for the safety of hot water systems and, in particular, prevention of explosion (G3);
• provision for the removal of condensate from high-energy boilers (H1);
• the use of grey water (H2) and the re-use of rainwater (H3);
• provisions for the control of air supply to combustion appliances (J1) and the discharge of the products of combustion (J2);
• protection of the building from combustion appliances (J3) and the positioning of liquid fuel storage to reduce risk of fire (J5);
• requirements for the control of energy in heating and hot water systems and the insulation of hot water pipes and storage vessels (L1 and L2);
• safe access to and use of buildings, and, in particular, sanitary provision for the less able (Part M); and
• electrical safety (P), which is increasingly applicable to water systems, e.g. controls to boilers and hot water/heating systems.

Building Regulation 7 requires building work to be carried out:

• using adequate and proper materials; and
• in a workmanlike manner.

Materials

Materials used in building work are required to be suitable for the purpose and conditions in which they are used and should not have any adverse affect on the health and safety aspects of building work.

Methods to establish fitness of materials are set out in Section 1 of the Approved Document to support Regulation 7. There are a number of ways in which compliance can be established:

• The material complies with a relevant and up to date British or European Standard. Most materials will conform to a British Standard and the material or its packaging will carry the BS Kitemark (see figure 1.2(a)). However, many of these are currently being revised to become European Standards. This transposition of the full range of standards will take place over a number of years. An example of this can be seen in copper tube which formerly complied with BS 2871 but is now manufactured to BS EN 1057 (see figure 1.2(c)).
• The material conforms to a technical specification of another European Member State providing its level of performance is at least equal to that of a British Standard (see figure 1.2 (d)).
• The material has CE marking which gives a presumption of conformance with legal minimum requirements as set out in the Construction Products Regulations 1991 (see figure 1.2(b)).
• Materials may be approved through one of a number of independent certification bodies within the UK many of which will be tested and approved through UKAS (United Kingdom Accreditation Service).
Additionally materials may be accepted if it can be shown by tests, by calculation, or by past experience that the material is capable of performing its intended function.

The material is covered by a national or European certificate issued by a European Technical Approvals Body, e.g. the British Board of Agrément. Unvented hot water storage appliances, for example, are required to be approved under these procedures. See chapter 3.

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**Figure 1.2 Material fitness approval marks**

- **(a) British Standards – Kitemark**
  - BS EN Standard number
  - MANUFACTURER’S NAME
  - pipe diameter (OD)

- **(b) European Standards – CE mark**
  - country of manufacture
  - BS kitemark

- **(c) Copper tube conforming to a European (EN) Standard**
  - wall thickness
  - hardness of material

- **(d) Copper fitting conforming to a technical specification of European Member State**
  - manufacturer’s mark
  - nominal pipe diameter 54 mm
  - DVGW shows fitting is approved by the German approval authority equivalent to the WRC
Workmanship

Good workmanship implies that the correct choice of materials is made, they are properly fixed and installed, and they adequately perform the functions for which they are intended. The adequacy of workmanship can be established in a number of ways. The work will be deemed to be satisfactory if:

- it is carried out in accordance with the recommendations of a current British Standard Code of Practice; or
- it conforms to a technical specification of a European Member State;
- it is covered by a national or European certificate issued by a European Technical Approvals Body; or
- workmanship can be established by following quality management schemes complying with BS EN ISO 9000 many of which will be accredited in the UK by UKAS.

Note Building Regulations Approved Document 7 refers to BS 8000 Workmanship on building sites, the section relevant to the application of this book being Part 15: 1990 Code of practice for hot and cold water services (domestic scale). It is unfortunate that this standard has not been updated to take account of the Water Supply (Water Fittings) Regulations 1999. Nor does it take account of recent amendments to Building Regulations, e.g. conservation of energy and electrical safety. For this reason Part 15 of BS 8000 should be read with care and direct reference made to current Water and Building Regulations.

Notification and self-assessment

Regulations 12, 13 and 14 set out provisions for self-certification schemes, which in turn are listed in Schedule 2A of the Regulations.

Under the above-mentioned Building Regulations, installers of hot water or heating installations, classed as ‘building work’, are required to notify a building control body that the work is to be carried out. This may be done:

- By making a ‘full plans’ application to the local authority or an approved inspector in accordance with Regulation 14. For the majority of hot water installations ‘full plans’ notification is not likely to be needed unless the installation is part of a larger construction project that itself requires a ‘full plans’ application. Most hot water installations are carried out as replacement or renewal of existing work and in these cases a building notice will normally suffice.
- By giving a building notice to the local authority or an approved inspector, detailing the work that is to be carried out along with information on the location of the work.

Following acceptance of the plans the installer is required to inform the building control body that he intends to commence the work, at least 2 days before the work is begun. Additionally, the control body should be notified within 5 days of completion of the work, that the work has been finished.

There are, however, exceptions to the above rules. A building notice or a full plans submission will not be required where the work is carried out on a ‘controlled service or fitting’ by a ‘competent person’ who is ‘approved’ under the regulations to carry out the work. In such cases the competent person may ‘self-certificate’ the work.
Note A controlled service or fitting means a service or fitting in relation to which Part G, H, J, L or P of Schedule 1 imposes a requirement.

Competent persons schemes have been introduced by government to permit individuals and businesses to self-certify that their work complies with Building Regulations as an alternative to submitting a building notice or using an approved inspector.

To be included in a scheme an operative or company will need to be assessed to ensure they have the required knowledge and expertise in the prescribed area of work. Once competency can be proved the operative will be permitted to issue a certificate to the customer that the work complies with relevant Building Regulations. He will also be required to send a similar notice to a building control body, within 2 days of completion, that the work has been finished.

A list of ‘building work’ that may be self-certificated is given in Schedule 2A of the Building Regulations along with details of the persons deemed competent to carry out the work. It should be noted that at the time of writing some of the building work listed in Schedule 2A does not have self-assessment schemes in place but schemes will be introduced as and when relevant parts of Schedule 1 are amended and re-written. Currently self-certification schemes are operating fully within the scope of Part L and Part P. (More schemes for other parts of the Regulations are in the pipeline.)

Part L: Conservation of fuel and energy in dwellings (L1 and L2)

Part L of the Building Regulations provides for the control of energy and conservation of fuel. Under the 2006 edition of Part L, provision must be made in both new and existing buildings to achieve improved energy efficiency compared with what was previously required. A proportion of these requirements apply particularly to hot water (and heating) installations.

Guidance as to how compliance can be achieved is given in Part L, which is completely re-written and published in four separate documents:

- Approved Document L1A Conservation of fuel and power in new dwellings
- Approved Document L1B Conservation of fuel and power in existing dwellings
- Approved Document L2A Conservation of fuel and power in new buildings other than dwellings
- Approved Document L2B Conservation of fuel and power in existing buildings other than dwellings

This book will look primarily at the documents L1A and L1B, which deal with work in dwellings.

The Domestic Heating Compliance Guide

To support the guidance given in Approved Documents L1A and L1B, the ODPM (Office of the Deputy Prime Minister) has published a second-tier document entitled the Domestic Heating Compliance Guide. Approved Documents L1A and L1B refer to the Guide which sets out minimum provisions for compliance with the hot water and space heating energy efficiency requirements of the Regulations. Figure 1.3 shows how the Domestic Heating Compliance Guide fits into the legislative process.
**Part M: Access to and use of buildings**

Part M of the Building Regulations applies mainly to non-domestic buildings but there are some exceptions including the provision of WCs in the entrance storey of dwellings. The object of Part M is to encourage the provision of facilities within buildings for those people who for various reasons have difficulty in using ‘normal’ conveniences and fittings. It calls for reasonable access in and around buildings to enable all people to make better and easier use of the building’s facilities.

Part M provisions were originally aimed towards those with some sort of disability, e.g. wheelchair users or ambulant disabled, but has been extended in the 2004 edition to accommodate the needs of all people and includes anyone with a limited physical ability, including people with babies and those encumbered with luggage.

The scope of this book in relation to Part M is concerned with sanitary facilities in buildings and in particular the safe supply and delivery of hot water, and the provision of taps, valves and mixers that are easy to use by everyone. See chapter 3.

**Part P: Electrical safety**

Electrical work in dwellings (including gardens and outbuildings) is controlled under Building Regulations Part P *Electrical safety.*
Electrical work, which includes installation, inspection and testing, is required to be notified to a local building control office, or to an approved inspector, at least 2 days before work is commenced, except when:

- The work is to be carried out by a ‘competent person’, who is listed on an approved register and is therefore capable of ‘self-certifying’ his or her own work; or
- The work is of a ‘minor’ nature and not installed in a ‘special installation’ or in a ‘special location’ or in a kitchen.

‘Minor work’ may include the replacement of electrical accessories such as socket outlets, control switches and ceiling roses. It includes the addition of socket outlets or lighting points to existing circuits but does NOT include the provision of a new circuit.

‘Special installations or locations’ include rooms with a bath or shower, swimming pools or paddling pools.

Within 30 days of completion of the work the competent person is required to complete a ‘Certificate of Compliance’ stating that the work complies with Building Regulations. This should be given to the person who has ordered the work and a further copy sent to a building control body.

Alternative routes to Part P compliance are shown in figure 1.4.

All electrical work is required to conform to the current edition of BS 7671 Requirements for electrical installations.

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**Figure 1.4 Routes to Part P compliance**

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### 1.4 The Health and Safety at Work etc. Act 1974

This Act provides for securing the health, safety and welfare of persons at work, for controlling the use and storage of dangerous substances and for the control of certain emissions into the atmosphere. The Health and Safety at Work etc. Act 1974 is an enabling act under which many safety regulations are made. Some of those relevant to this book include:
- The Workplace (Health, Welfare and Safety) Regulations which regulate the provision of drinking water and sanitary accommodation in the workplace.
- The Gas Safety (Installation and Use) Regulations, used to control the installation of gas appliances, provide for the registration of gas installers and require that all gas-fitting operatives shall be competent in the area of gas work that they do.
- The Control of Asbestos at Work Regulations.
- Control of Substances Hazardous to Health Regulations.

1.5 Definitions

Definitions given here are taken from BS 7600, the Water Fittings Regulations and from Building Regulations. Definitions are important to the understanding of the document in which they are given. For this reason, different interpretations are sometimes given to the same term depending on which document they are taken from. For example, ‘building’ is given a different interpretation under BS 6700 than that shown under Building Regulations.

From BS 6700

backflow means flow upstream, that is in a direction contrary to the intended direction of flow, within or from a water fitting
building means a structure (including a floating structure) of a permanent character or not, and movable or immovable, connected to the water supplier’s mains
cavity wall means a structural or partition wall, formed by two upright parts of similar or dissimilar building materials, suitably tied together with a gap formed between them, which might be (but need not be) filled with insulating material
chase means a recess cut into an existing structure
cistern means a fixed, vented container for holding water at atmospheric pressure
combined feed and expansion cistern means a cistern for supplying cold water to a hot water system without a separate expansion cistern
composite fitting means a combination of fittings or valves incorporated into one body
contamination means a reduction in chemical or biological quality of water due to a change in temperature or the introduction of polluting substances
cover means a panel or sheet of rigid material fixed over a chase, duct or access point, of sufficient strength to withstand surface loadings appropriate to its position. NOTE: Except where providing access to joints or changes of direction (i.e. at an inspection access point), a cover may be plastered or screeded over
direct hot water supply system means a hot water supply system in which the water supplied to draw-off points is heated by a direct source of heat
distributing pipe means a pipe (other than a warning, overflow or flushing pipe) conveying water from a storage cistern, or from hot water apparatus supplied from a cistern and under pressure from that cistern
**duct** means an enclosure designed to accommodate water pipes and fittings and other services, if required. *NOTE: Ideally, a duct should be constructed so that access to the interior can be obtained either throughout its length or at specified points by removal of a cover or covers.*

**dwelling** means premises, buildings or part of a building providing accommodation, including a terraced house, a semi-detached house, a detached house, a flat in a block of flats, a unit in a block of maisonettes, a bungalow, a flat within any non-domestic premises, a maisonette in a block of flats, or any other habitable building and any caravan, vessel, boat or houseboat that can accommodate a single family unit connected to the water supplier’s mains.

**expansion valve** means a pressure-activated valve designed to release expansion water from an unvented water heating system.

**flushing cistern** means a cistern provided with a valve or device for controlling the discharge of the stored water into a water closet pan or urinal.

**indirect hot water supply system** means a hot water supply system in which the water supply to draw-off points is heated by an indirect cylinder or calorifier.

**inspection access point** means a position of access to a duct or chase whereby the pipe or pipes therein can be inspected by removing a cover which is fixed by removable fastenings but does not necessitate the removal of surface plaster, screed or continuous surface decoration.

**overflow pipe** means a pipe from a cistern in which water flows only when the level in the cistern exceeds a predetermined level.

**pressure relief valve** means a pressure-activated valve which opens automatically at a specified pressure to discharge fluid.

**primary circuit** means an assembly of water fittings in which water circulates between a boiler or other source of heat and a primary heat exchanger inside a hot water storage vessel, and includes any space heating system.

**removable fastenings** means fastenings that can be removed readily and replaced without causing damage, including turn buckles, clips, magnetic or touch latches, coin-operated screws and conventional screws, but not nails, pins or adhesives.

**RPZ valve** means a type BA backflow protection device that conforms to BS EN 1717. *NOTE: ‘RPZ valve’ stands for ‘verifiable backflow preventor with reduced pressure zone’.*

**secondary circuit** means an assembly of water fittings in which water circulates in supply pipes or distributing pipes of hot water storage system.

**secondary system** means an assembly of water fittings comprising the cold feed pipe, any hot water storage vessel, water heater and pipework from which hot water is conveyed to all points of draw-off.

**servicing valve** means a valve for shutting off, for the purpose of maintenance, the flow of water in a pipe connected to a water fitting or appliance.

**sleeve** means an enclosure of tubular or other section of suitable material designed to provide a space through an obstruction to accommodate a single water pipe and to which access to the interior can be obtained only from either end.
stopvalve means a valve, other than a servicing valve, used for shutting off the flow of water in a pipe

storage cistern means a cistern for storing water for subsequent use, not being a flushing cistern

tap size designations means numbers directly related to the nominal size of the thread on the inlet of the tap, which in turn is unchanged from the nominal size in inches before metrical (e.g., 1\½ nominal size tap means a tap with an inlet having a G 1\½ thread)

tank means a closed vessel holding water at greater than atmospheric pressure

temperature relief valve means a valve which opens automatically at a specified temperature to discharge fluid

terminal fitting means a water outlet device

tundish means a funnel for catching overflow or discharge

vent pipe means a pipe, open to the atmosphere, which exposes the system to atmospheric pressure

walkway or crawlway means an enclosure similar to a duct, but of such size as to provide access to the interior by persons through doors or manholes and which will accommodate water pipes and fittings and other services if required

warning pipe means a pipe from a cistern in which water flows only when the level in the cistern is about to exceed the predetermined overflow level to warn of impending overflow

From Water Regulations

A further list of definitions relating to Schedule 2 of the Water Supply (Water Fittings) Regulations 1999:

backflow means flow upstream, that is in a direction contrary to the intended normal direction of flow, within or from a water fitting

cistern means a fixed vented container for holding water at atmospheric pressure

combined feed and expansion cistern means a cistern for supplying cold water to a hot water system without a separate expansion cistern

combined temperature and pressure relief valve means a valve capable of performing the function of both a temperature relief valve and a pressure relief valve

concealed water fitting means a water fitting that:
(a) is installed below ground;
(b) passes through or under any wall, footing or foundation;
(c) is embedded in any wall or solid floor;
(d) is enclosed in any chase or duct; or
(e) is in any other position which is inaccessible or renders access difficult

contamination includes any reduction in chemical or biological quality of water due to raising its temperature or the introduction of polluting substances
distributing pipe means any pipe (other than a warning, overflow or flush pipe) conveying water from a storage cistern, or from hot water apparatus supplied from a cistern and under pressure from that cistern

expansion cistern means a cistern connected to a water heating system which accommodates the increase in volume of that water in the system when the water is heated from cold

expansion valve means a pressure-activated valve designed to release expansion water from an unvented water heating system

overflow pipe means a pipe from a cistern in which water flows only when the water level in the cistern exceeds its normal maximum level

pressure flushing cistern means a WC flushing device that utilizes the pressure of water within the cistern supply pipe to compress the air and thus increase the pressure of water available for flushing a WC pan

pressure relief valve means a pressure-activated valve which opens automatically at a specified pressure to discharge fluid

primary circuit means an assembly of water fittings in which water circulates between a boiler or other source of heat and a primary heat exchanger inside a hot water storage vessel

secondary circuit means an assembly of water fittings in which water circulates in supply pipes or distributing pipes to and from a hot water storage vessel

secondary system means that part of any hot water system comprising the cold feed pipe, any hot water storage vessel, water heater and flow and return pipework from which hot water is conveyed to all points of draw-off

servicing valve means a valve for shutting off the flow of water in a pipe connected to a water fitting for the purpose of maintenance or service

spill-over level means the level at which the water in a cistern or sanitary appliance will first spill over if the inflow of water exceeds the outflow through any outflow pipe and any overflow pipe

stop valve means a valve, other than a servicing valve, for shutting off the flow of water in a pipe

supply pipe means so much of any pipe as is not vested in the water undertaker

temperature relief valve means a valve which opens automatically at a specified temperature to discharge water

terminal fitting means a water discharge point

unvented hot water storage vessel means a hot water storage vessel that is not provided with a vent pipe but is fitted with safety devices to control primary flow, prevent backflow, control working pressure and accommodate expansion

vent pipe means a pipe open to the atmosphere which exposes the system to atmospheric pressure at its boundary

warning pipe means an overflow pipe whose outlet is located in a position where the discharge of water can be readily seen
From Building Regulations

A selection of terms and definitions from Regulation 1 is as follows:

**building** means any permanent or temporary building but not any other kind of structure or erection, and a reference to a building includes a reference to part of a building

**building work** has the meaning given in Regulation 3(1). NOTE: **Building work includes:** the provision or extension of a controlled service or fitting in or in connection with a building and the material alteration of a controlled service or fitting. For a full definition readers should consult Regulation 3(1)

**controlled service or fitting** means a service or fitting in relation to which Part G, H J, L or P of Schedule 1 imposes a requirement

**domestic hot water** means water that has been heated for ablution, culinary and cleansing purposes. The term is used irrespective of the type of building in which an unvented hot water storage system is installed

**dwelling** includes a dwelling-house and a flat

**dwelling-house** does not include a flat or a building containing a flat

**energy rating** of a dwelling means a numerical indication of the overall energy efficiency of that dwelling obtained by the application of a procedure approved by the Secretary of State under regulation 16(2) of the Regulations

**European Technical Approval issuing body** means a body authorized by a Member State of the European Economic Area to issue European Technical Approvals (a favourable technical assessment of the fitness for use of a construction product for the purposes of the Construction Products Directive (a))

**final certificate** means a certificate given under Section 51 of the Act

**flat** means separate and self-contained premises constructed or adapted for use for residential purposes and forming part of a building from some other part of which it is divided horizontally

**full plans** means plans deposited with a local authority for the purposes of Section 16 of the Act in accordance with Regulations 12(2)(b) and 14

**initial notice** means a notice given under section 47 of the Act

**package** means an unvented hot water storage system having the safety devices described in paragraph 3.3 or 3.4 factory-fitted together with a kit containing other applicable devices, supplied by the package manufacturer, to be fitted by the installer

**unit** means an unvented hot water storage system having the safety devices described in paragraph 3.3 or 3.4 and all operating devices factory-fitted by the manufacturer

**unvented hot water storage system** means an unvented vessel for either:

a) storing domestic hot water for subsequent use; or
b) heating domestic water that passes through an integral pipe or coil (e.g. water jacketed tube heater/combi boiler)

and fitted with safety devices to prevent water temperatures exceeding 100°C and other applicable operating devices to control primary flow, prevent backflow, control working pressure and accommodate expansion
1.6 **Graphical symbols**

See figure 1.5.

Symbols used in this book are, where possible, based on those given in BS 1192: Part 3. However, there are many components not included in BS 1192, so symbols from other sources have been used.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>ref. BS 1192 EN 806-1</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>draw-off tap (valve port)</td>
<td>7.3 7.4 6.4.1</td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>shower head</td>
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</tr>
<tr>
<td><img src="image4" alt="Symbol" /></td>
<td>sprinkler head (spray outlet)</td>
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<td>float-operated valve (ballcock)</td>
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<td><img src="image8" alt="Symbol" /></td>
<td>float switch (hydraulic type)</td>
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<tr>
<td><img src="image9" alt="Symbol" /></td>
<td>float switch (magnetic type)</td>
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<td><img src="image10" alt="Symbol" /></td>
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<tr>
<td><img src="image12" alt="Symbol" /></td>
<td>supply stopvalve (SV) (valve)</td>
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<td><img src="image14" alt="Symbol" /></td>
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*Figure 1.5  Graphical symbols and abbreviations used in this book*
<table>
<thead>
<tr>
<th>Symbol</th>
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<td>draining valve (BS 1192) (drain valve) (drain cock)</td>
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<td><img src="image5" alt="Line Strainer" /></td>
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<td><img src="image7" alt="Pressure Reducing Valve" /></td>
<td>pressure reducing valve (small end denotes high pressure)</td>
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<tr>
<td><img src="image9" alt="Expansion Vessel" /></td>
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<td><img src="image11" alt="Pressure Relief Valve" /></td>
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<td>check valve or non-return valve (NRV)</td>
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<td><img src="image17" alt="Combined Check and Anti-Vacuum Valve" /></td>
<td>combined check and anti-vacuum valve (check valve and vacuum breaker)</td>
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<td><img src="image18" alt="Diagram" /></td>
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<td><img src="image19" alt="Air Inlet Valve" /></td>
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**Figure 1.5 continued**
<table>
<thead>
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<th>ref. BS 1192 EN 806-1</th>
<th>Application</th>
</tr>
</thead>
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<td>cold water storage cistern (storage and feed cistern) (feed cistern)</td>
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<tr>
<td>F&amp;ExC</td>
<td>feed and expansion cistern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HWC</td>
<td>hot water storage cylinder or tank (plan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>direct hot water storage cylinder or hot store vessel (elevation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>indirect hot water storage cylinder or hot store vessel (elevation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>boiler (elevation)</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>temperature relief valve (spring loaded safety valve)</td>
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</tr>
<tr>
<td></td>
<td>tundish</td>
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</table>

*Figure 1.5 continued*
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>ref. BS 1192 BSEN 806-1</th>
<th>Application</th>
</tr>
</thead>
<tbody>
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<tr>
<td><img src="pump.png" alt="pump" /></td>
<td>pump (circulating)</td>
<td>7.608</td>
<td><img src="pump%E5%BA%94%E7%94%A8.png" alt="pump广泛应用" /></td>
</tr>
<tr>
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<td>automatic air vent</td>
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<td>![wash basin](wash basin.png)</td>
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<td>![wash basin广泛应用](wash basin应用.png)</td>
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<td><img src="bidet.png" alt="bidet" /></td>
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<td><img src="bidet%E5%BA%94%E7%94%A8.png" alt="bidet广泛应用" /></td>
</tr>
<tr>
<td><img src="bath.png" alt="bath" /></td>
<td>bath (elevation)</td>
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</tr>
<tr>
<td><img src="WC.png" alt="WC" /></td>
<td>water closet (WC) (elevation)</td>
<td></td>
<td><img src="WC%E5%BA%94%E7%94%A8.png" alt="WC广泛应用" /></td>
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<tr>
<td>![urinal bowl](urinal bowl.png)</td>
<td>urinal bowl (elevation)</td>
<td></td>
<td>![urinal bowl广泛应用](urinal bowl应用.png)</td>
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</tbody>
</table>

**Figure 1.5 continued**
BS 1192 is now withdrawn and is replaced by a number of EN standards. Unfortunately it has proved extremely difficult to find a range of EN symbols that are suitable for this book. The author has for the present retained the original symbols and made reference to EN symbols where appropriate.

1.7 Materials

Selection and use of materials are dealt with in greater depth in chapter 11.

Choice of material for a particular water installation may be determined by the following factors:

- effect on water quality;
- cost, service life and maintenance needs;
- internal and external corrosion (particularly from certain waters);
- compatibility of materials;
- ageing, fatigue and temperature effects, especially in plastics;
- mechanical properties and durability;
- vibration, stress or settlement;
- internal water pressures;
- internal and external temperatures;
- permeation.

The water supplier should be consulted at an early stage, particularly about the choice of materials in relation to the character of the water supply and ground conditions. Some waters are aggressive to certain pipes as are certain types of soil. The water supplier should be able to advise on local conditions, and give guidance on the suitability and application of proposed materials.

Pipes and fittings should be used only within the limits stated in relevant British or European Standards and in accordance with any manufacturers’ recommendations, and the requirements of Water or Building Regulations should be met.

Manufacturers should identify pipes and components, either on the product or its packaging, with the following information:

- a product standard number, i.e. EN XXX;
- the manufacturer and site of production;
- the year of manufacture;
- the certification body, if any;
- its class (or grade), where applicable; and
- where applicable, suitability for use with potable water.

Installations should be capable of operating effectively under the conditions they will experience in service. Pipes, joints and fittings should be capable of withstanding sustained temperatures as shown in table 1.1, without damage or deterioration.

Pipes, joints and fittings of dissimilar metals should not be connected together unless precautions are taken to prevent corrosion. This is particularly important in below ground installations where conditions are often conducive to corrosion.
Table 1.2 gives a selection of pipes of various materials along with a range of comparative internal and external diameters.

Detailed information on pipes and fittings can be seen in chapter 11.

**Pipe sizes**

Since about 1970 many pipe sizes have gradually changed from imperial to metric measurement. Pipes in some materials were metricated quickly, e.g. copper, while others even now retain their imperial identification.

With metrication came a move away from designating pipe sizes by the inside diameter towards the use of the outside diameter.

Currently European Standards are being developed and are replacing many of our existing British Standard specifications.

Table 1.2 provides a comparison between the sizes of pipes of different materials, using inside diameters as a base, because it is the inside diameter which determines the water-carrying capacity of the pipe.

Polyethylene tube, low density to BS 1972 and high density PE tube to BS 3284, has been widely used in the past for applications in farming and agriculture. It was also extensively used for supply pipes to dwellings and other buildings. In the mid 1980s blue medium density tube to BS 6572 and black medium density tube to BS 6730 were introduced. Two main changes occurred at this time: pipe sizes were changed from internal dimensions to external measurement and blue polyethylene tube was introduced to provide ready identification of pipes below ground.

Thousands of pipelines using all of these materials have been installed over the years and will remain in use for many years to come. It is important that information on these pipes is still available because connections and repairs will still need to be made to many of them in the future.

More recently standards for polyethylene pipes have changed again. The above standards are expected to be replaced by BS EN 12201 Parts 1 to 5, which sets out requirements for pipes, valves and fittings. However, for the time being BS 6572 and BS 6730 are still current.

BS EN 805 specifies two series of nominal sizes for pipes and components for water supply. These cover sizes within the range 20 mm to 4000 mm and should be designated by the use of DN. One relates to internal diameter (DN/ID) and the other to external diameter (DN/OD) but for this book extracts are shown up to size 200.

- DN/ID:  20, 30, 40, 50, 60, 65, 80, 100, 125, 150, 200
- DN/OD: 25, 32, 40, 50, 63, 75, 90, 110, 125, 160, 180, 200
### Table 1.2 Equivalent pipe sizes

<table>
<thead>
<tr>
<th>Comparative internal size</th>
<th>Copper* to BS EN 1057</th>
<th>Stainless Steel to BS EN 10312</th>
<th>Steel (screwed) (galvanized or black)* to BS 1387</th>
<th>Grey iron to BS 4622</th>
<th>Ductile iron to BS EN 545</th>
<th>Fibre cement* to BS EN 512: 19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparative internal size in millimetres</td>
<td>nominal size</td>
<td>nominal size (DN)</td>
<td>nominal size</td>
<td>thread designation</td>
<td>nominal diameter (DN)</td>
<td>nominal diameter (DN)</td>
</tr>
<tr>
<td>ID mm</td>
<td>OD mm</td>
<td>ID mm</td>
<td>OD mm</td>
<td>ID mm</td>
<td>OD mm</td>
<td>ID mm</td>
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<td>4.8</td>
<td>4.8</td>
<td>6</td>
<td>-</td>
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<tr>
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</table>

**Note:** Some intermediate sizes have been omitted.

*In some materials only one grade is shown.

†Larger sizes have been excluded.
<table>
<thead>
<tr>
<th>Comparative internal size in millimetres</th>
<th>Unplasticized (PVC-U) to BS 3505 (Class E)</th>
<th>Propylene copolymer to BS 4991</th>
<th>Polyethylene to BS 6572 medium density</th>
<th>Polyethylene to BS 6730 medium density</th>
<th>Polyethylene to BS 1972 low density (withdrawn)</th>
<th>Comparative internal size in inches</th>
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</table>

Note: Some intermediate sizes have been omitted.
* In some materials only one grade is shown.
† Larger sizes have been excluded.
BS 3505 is to be replaced by BS EN 1452.
BS 6572 and BS 6730 are to be replaced by BS EN 12201.
Table 1.2 continued Flexible pipes (continued)

<table>
<thead>
<tr>
<th>Comparative internal size in millimetres</th>
<th>Polybutylene (PB) to BS 7291: Parts 1 and 2</th>
<th>Cross-linked polyethylene (PE-X) to BS 7291: Parts 1 and 3</th>
<th>Chlorinated polyvinyl chloride (PVC-C) to BS 7291: Parts 1 and 4</th>
<th>Comparative internal size in inches</th>
</tr>
</thead>
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<td>Consistent with BS 5556 nomnial size</td>
<td>Consistent with BS 2871 nominal size</td>
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1.8 Initial procedures

Hot and cold water installations should be designed to conform with Water Regulations (byelaws in Scotland) and with relevant parts of Building Regulations. Consideration should be given to economic maintenance of the installation throughout its working life. Particular attention should be given to the prevention of bacterial contamination in both hot and cold water services. Bacterial contamination is more likely to occur in buildings of multiple occupation. Systems should be designed to avoid trapping of air and formation of air locks during operation. Temperatures of both hot and cold water should be controlled to avoid conditions which encourage bacterial growth. Guidance on the preservation of water quality is given in chapter 6.

Attention should also be given to the insulation and control of temperatures for the conservation of energy.

Preliminary design factors are as follows:

- flow requirements and estimated likely consumption;
- location of available water supply;
- quality, quantity and pressure of available supply;
- quantity of storage required;
- requirements of Building Regulations and Water Regulations and particularly the need for notification of work;
- ground conditions, e.g. subsidence/contamination of site;
- liaison with other parties;
- the specific requirements of the water supplier;
- the likelihood of transient and surge pressures during system operation.

The design should include provision for appliances likely to be added later.

Availability of water supplies

Water supplies are available from:

1. Nearby public water main at cost to owner or within contract price. If not readily available, the water undertaker must provide mains at the expense of the owner or applicant. It is important that the water supplier is consulted at an early stage.
   **Note** Mains may not be laid until road line and kerb level are permanently established.

2. Suitable and available supply pipe (not favoured by water suppliers who generally insist that each premises has a separate supply pipe).

3. Private source. The condition and purity of the water should be considered. Chemical and bacterial analyses are advisable before the source is used. Approval is needed from the local public health authority for drinking water supplies, and a licence to abstract may be required from the water authority.
   **Note 1** If private supply and public supply are taken to a single property, the water undertaker must be informed and regulations complied with. Water from a private source must not be connected to a supply pipe from a water supplier’s main.
   **Note 2** The water supplier may require the supply to be metered.
(4) Water supplies may be supplemented by the use of reclaimed waste water or rainwater collected from roofs provided that precautions are taken for the prevention of contamination.

Water suppliers will need full details of non-domestic water supply requirements to assess the likely demand and effects on water mains and other users in the locality (see figure 1.6).

### Figure 1.6 Water suppliers’ requirements

**Ground conditions to be considered**

1. Likelihood of contamination of site (local authorities may provide information).
2. Likelihood of subsidence and other soil movement from:
   - (a) mining;
   - (b) vibration from traffic (consider increased depth);
   - (c) moisture swelling and contraction;
   - (d) building settlement.

### Laying pipes outside buildings

When laying underground service pipes make allowances for pipe materials, jointing and methods of laying. Consider methods of passing pipes through walls. Pipes must be free to deflect.

As far as possible underground pipes:

- should be laid at right angles to the main;
- should be laid in straight lines to facilitate location for repairs, but with slight deviation to adjust to minor ground movement;
- should not be laid under surfaced footpaths or drives;
- should be laid at a minimum depth of 750 mm to avoid frost and other damage, and not deeper than 1350 mm to permit reasonable access.
Service pipe diameters should be determined by hydraulic calculation. Flow velocities should preferably be kept within the range 0.5 m/s to 2 m/s but in exceptional circumstances a maximum velocity of 3.5 m/s may be allowed. To avoid undue stresses in the pipeline due to thermal movement, consideration should be given to the temperature of the pipeline when installed compared with the expected temperature when filled and in use. Provision should be made for the flushing and removal of air and for the testing of the pipeline. Where applicable the pipeline should be sterilized and samples taken for chemical and bacterial analyses.

The use of external pipes above ground should be avoided. Where unavoidable, pipes should be lagged with water-proofed insulation and provision made to drain pipes as a precaution against frost.

**Liaison and consultation**

From an early stage in the design process, the designer should consult with others involved in the design, installation and use of the system (see figure 1.7).

Where work is to be carried out in a public highway, the highway authority and all private/public utility undertakers should be notified and all relevant notices completed and lodged with those likely to be affected. These notices should include any drawings and other details of work to be done. Particular attention should be given to the submission of notices to water undertakers and to building control bodies, to whom notice should be given before commencement of the work. Designers and installers should be aware of requirements under both Water and Building Regulations for the notification of work, and of conditions relating to the self-certification of work.

The designer or installer should provide full working drawings, including precise location of all pipe runs, method of ducting, description of all appliances, valves and other fittings, methods of fixing, protections and precautions.
Water pipes of metal should be arranged to permit equipotential bonding to the main electrical earth.

The programme of work should consider:

- method of construction;
- sequence of events including handover to owner;
- coordination of services;
- time needed for construction and services works;
- size and position of incoming services.

Water services to buildings should be coordinated with other services and laid in an orderly sequence and at a line and level that will readily permit maintenance at a later date. On new sites the recommendations of the *National Utilities Group Publication No 6* should be followed.