
7. Codes of practice for plumbing

A code of practice is intended to ensure the quality and functionality of plumbing systems and to protect the health of the occupants of the premises where a plumbing system is to be installed, as well as the health of the public in general. National codes of practice are often designed to cover all the states, territories or provinces in that country, and their content applies to all plumbing proposals. In some instances, the national code may only cover technical specifications and local authorities may need separate by-laws or regulations to regulate administrative matters for connection to the authority's water, sewerage or drainage systems.

Quality assurance is a major strategy for risk minimization in the supply of water and disposal of wastewater. A major component of quality assurance programmes in plumbing is the use of codes of good practice that specify the requirements to be met to assure conformance with norms. These codes are usually supported by legislation or by local government regulations and are therefore referred to as codes of practice or mandatory codes of practice. In some countries, the term "ordinance" is used to describe them. The term "code of practice" is used in this document.

Codes of practice attempt to minimize risk by specifying technical standards of design, materials, workmanship and maintenance for plumbing systems. Some model text having particular health significance and a sample model plumbing code of practice (ordinance) is provided in section 7.1. Citations to other codes are also provided for reference.

The primary aims of a plumbing code of practice are to ensure the following:

- that planners, administrators and plumbers develop the required competency so these codes are respected and applied;
- that standards are set to ensure that plumbing assemblies, materials and technologies are safe and effective;
- that plumbing installations meet these standards;
- that plumbing installations are maintained to ensure continuous safety and effectiveness.

The economic, geographic, demographic and cultural circumstances relating to plumbing needs vary from country to country and from region to region. The plumbing code of practice for any given community must take these variations into account and specify minimum standards accordingly.

The responsibility for overseeing the implementation of the code of practice is awarded to a designated authority such as a national or state government department or a local government organization. The designated authority must have the requisite competence, and the power and responsibility to enforce compliance within its area of jurisdiction. The essential feature of the authority is that responsibility and power of implementation are vested in a single identifiable body, whose responsibilities and authority are clearly defined in the plumbing code of practice. The concept of undivided responsibility for enforcing the code of practice is particularly important since there may be numerous authorities that have specific roles and requirements linked to plumbing systems. They may include water and sewerage authorities, health departments, building (including plumbing) code officials, food and drug officials, and bodies that deal with environment, tourism, housing, industry and transportation. Plumbing codes of practice should address the unique requirements of each of these different bodies so that a building owner, builder or plumber need only deal with a single authority.

One of the most effective ways to establish standards and ensure compliance is through a national plumbing code of practice that is enforced by a national government department or ministry. This national authority may in turn delegate its powers to state, provincial or local governments. In this way, a set of all-inclusive national standards and regulations can be adopted in whole or in part to suit the specific requirements of the particular jurisdiction. It is not always necessary to develop de novo a code or standards since many models are available; however, it will usually be necessary to adapt a chosen code to local conditions. Some examples of local variations could include piping materials to suit local corrosive water conditions, or the depth of buried piping required to prevent freezing.

In some areas, the local authority may establish committees to advise it on matters dealing with the administration of the plumbing code. This could be in the form of a plumbing board to deal with the qualifications and licensing of plumbers, and a committee to deal with technical issues in the code of practice. These committees would ideally include design engineers, installation contractors and labour representatives.

A typical plumbing code of practice will grant the following powers to the authority charged with enforcing compliance:

- the right to register and license plumbers to specified qualifications;
- the right of entry to facilities for the purpose of making inspections;
- the establishment of procedures and conditions under which permits for plumbing installations may be granted;
- the right to charge fees for granting plumbing licences and permits, in accordance with an approved scale;
- the right to take administrative actions and actions in the courts of law in the event of violations.

The success of newly adopted plumbing codes of practice and associated regulations depends to a significant extent on acceptance by the public. Education programmes may be needed to inform the public of the health and safety benefits of regulated plumbing installations and the dangers of non-compliance.

The formulation of a plumbing code of practice is a demanding task. However, most of the challenges have already been addressed in the preparation of codes of practice in countries and cities around the world, and many of these codes have stood the test of time. Many codes emphasize the aims and roles of a code of practice in the form of a preamble or the presentation of general principles, which sets the scene for the regulations that follow.

7.1 A sample model code of practice

This section offers some model text taken from existing codes of practice as illustrations to assist those preparing a code of practice. A typical introductory statement could be as follows:

The following standards and regulations for plumbing systems were prepared under the authority of paragraph XXX [page YYY] of the plumbing code of practice number ZZZ dated AAA and adopted by the Authority or Town Council of MMM, being the authority having jurisdiction, at its meeting on BBB.

The following is a sample code of practice that designates the town council (or other authority) of the municipality as the authority having jurisdiction over plumbing in its area:

1. The town council of the municipality (referred to here as “the authority”) is hereby designated as the authority having jurisdiction over all plumbing systems within the boundaries served by the public drinking-water supply system of the municipality.
2. For the purposes of this Code of Practice the words “plumbing systems” shall be taken to mean all water pipes, drains, sanitary fixtures and other installations, whether within or outside buildings, connected or capable of being connected in the future, directly or indirectly, to a public water main or to a public sewer, irrespective of whether these plumbing systems are publicly or privately owned.
3. The authority shall specify standards and regulations as it considers necessary to ensure that all plumbing systems within its jurisdiction are designed, installed and maintained in accordance with accepted sanitary principles. These standards and regulations shall comprise the “plumbing code of practice” of the municipality, that is referred to here as “the code”.
4. The authority shall administer the code, for which purpose it shall engage such staff or assistance as is necessary and shall take such actions as may be necessary and reasonable to obtain compliance with its provisions, as regards both

plumbing systems already existing within its area and those to be installed at any time in the future.

5. No person shall construct, install, extend or materially alter any plumbing system without making formal application to, and receiving formal approval from, the authority. Contravention of the code will be sufficient grounds for approval to be withheld.
6. The authority shall maintain a register of persons qualified under the regulations of the examining board of the national association of plumbers who have applied to have their names entered. The authority may grant a licence, at its discretion, to anyone so registered to become a “licensed plumber”, after it is satisfied that such person is capable, of good repute, and familiar with the provisions of the code. Licences of a grade commensurate with the applicant’s qualifications and experience shall be granted for a fixed period of years, after which they may be renewed after reapplication, but the authority shall have the power to revoke or terminate a licence in the event of unsatisfactory work or deliberate breach of the provisions of the code. In the event of a dispute regarding the issuing, renewal or termination of a plumber’s licence, such dispute may be referred to an arbitrator, nominated by the authority or incumbent president of the national association of plumbers and acceptable to both parties, whose decision shall be binding.
7. Except where the authority shall agree in writing to other dispositions, only a licensed plumber shall be authorized to be responsible for the construction, repair, alteration or removal of pipes, valves, drains or other appurtenances of any drinking-water supply or drainage system (including storm drainage discharging into a public sewer or watercourse) in any building or on any land. Only a licensed plumber may make a connection to a public water main or to a public sewer, and he shall be responsible for giving notice to the water and sewerage authorities of the intention of making such connection for satisfying any requirements of those bodies.
8. The authority may require any plumber to whom a licence is granted under this code to deposit a performance bond in an amount to be agreed, but not exceeding (the sum to be stated) with the authority. This bond shall certify that all plumbing work performed by the licensee or under his supervision shall be in accordance with the provisions of the code, and that in the case of any violation of any of these provisions he shall pay all fines or penalties properly imposed by the council. A schedule of such fines or penalties accompanies this code of practice.
9. The authority shall specify the grades and quality of materials that are acceptable for use in the water and sewerage systems in its jurisdiction. The authority shall have the right to condemn any used plumbing materials or equipment which the authority deems to be so worn, damaged or defective that its reuse would constitute a sanitary or safety hazard. Such condemned material shall be promptly removed from the site and shall not be reused for plumbing in

the area under the jurisdiction of the authority. It is not the intention of this paragraph that used material which is capable of satisfactory reuse shall be condemned solely on the grounds that it is not new.

10. The duly delegated representative of the authority (referred to here as “the inspector”) shall have the right of entry into premises for which proposals for the installation of plumbing systems have been submitted to the authority, or in which plumbing has already been installed. Such entry shall be made at a reasonable hour and in the company of a representative of the owner or occupant.
11. Particular premises in which there exists any dual water system, premises in which food, drink or other material susceptible to contamination is prepared, stored or offered for sale, and any other premises which in the opinion of the authority present any special health hazards, shall be periodically examined by the inspector, after a minimum of 24 hours’ notice has been given to the owner or occupant, to confirm that the plumbing system is being maintained satisfactorily and in conformity with the code.
12. In the event of any breach of the code the authority shall, within one calendar month of the contravention’s being brought to its attention, serve notice upon the offender specifying the nature of the offence and the measures required to remedy it. At the same time, where applicable, it shall draw attention to the statutory penalty specified for the breach of the code, as listed in the schedule of penalties accompanying and forming part of this code of practice. Payment of the penalty and completion of the specified remedial works shall discharge the offence.
13. In the event that the person receiving notice from the authority disputes the offence in writing within 60 days of receipt of the aforesaid notice, the authority may take steps to refer the dispute to a court of law or to a form of arbitration to be agreed upon by the parties concerned, both sides to be bound by the decision so reached.
14. The authority may refuse to grant permission for a plumbing installation to be connected to the public water mains or sewers if it has reason to believe that the system contravenes the plumbing code. In such a case the owner or occupant of the premises concerned may call upon the authority to provide details of the alleged infringement of the code. In the event of dispute the matter shall be referred to a court of law or other form of arbitration.

The model code may need to be varied depending on factors such as the following:

- whether or not the “authority having jurisdiction” for plumbing is also the water and sewerage authority;
- if a single municipal, state, or provincial authority has coverage of a number of local communities;

- whether of not there is a national system for the training and examination of plumbers;
- whether the plumbing authority is also responsible for the administration of building regulations.

The following sections elaborate on the code of practice and provide additional context and discussions on particular aspects of the code.

7.2 Applications for approval to install plumbing systems

The process of application for a plumbing proposal will vary from authority to authority. Some authorities may only require a written application, and others may require plans and figures detailing the plumbing proposal supported by existing building details:

Application for the authority's approval for plumbing proposals in accordance with paragraph XXX [page YYY] of the plumbing code of practice shall be in such form and must be accompanied by such plans as the authority may require.

If the authority requires standard forms to be used for applications, approvals, appeals or other purposes, a schedule with a sample of forms can be attached to the code or made readily available by other means.

Where an authority requires plans to accompany applications such requirements should also be clearly defined. If these requirements may be relaxed in certain cases those circumstances should be described in the text.

A sample description of plan requirements is given below:

Plans accompanying applications for permission to install, extend or alter plumbing systems must be submitted in duplicate and one copy will be retained by the authority. The second copy will be returned to the applicant with the authority's formal approval.

Plans shall consist of elevations and sections as necessary, drawn to a scale of not less than 1:100, showing the following details in relation to all structural features of the building:

- (a) Every plumbing fixture, soil-pipe, drain, water service, ventilating pipe, storm water pipe, grease-trap, interceptor or other apparatus, if required, including the size and gradient of all drains and the diameter of all other piping;
- (b) The height and position of chimneys, windows or other features of the building within a distance of 6 m (20 ft) from the open end of any soil-pipe or ventilating pipe;
- (c) The level of the lowest floor of the building and of the surrounding open spaces, and the relative level of the highway, street, lane, and of the invert of any sewer which is to be connected to the drains.

A block plan, to a scale of not less than 1:1000, shall also be provided showing the premises at which the work is to be carried out, the limits of the property, the

positions of the public water main and any sewer at which connections will be made, together with other relevant details. The premises must be accurately identified by property number or name and street name. The position and diameter of the proposed water service between the main and the premises, as well as the size, gradient and line of any drain, septic tank or other method of waste disposal, must also be shown.

Most authorities will not permit the discharge of storm water into the authority sanitary sewerage system. Plans of storm water drainage may be required by some other authorities.

The plan must include, or be accompanied by, adequate specifications and descriptions of the work proposed. They must be signed by the applicant, who shall state whether he or she is the owner, occupant or agent of the property. If the applicant is not the owner then the owner's name and address shall be shown.

The plans must indicate the intended use of each building covered by the application. Except in the case of single domestic units, the estimated daily consumption of water on which the plumbing design has been based must be clearly shown. Additional allowances may also be required for firefighting services.

If it is intended that the water service pipe, drain or any other part of the plumbing system shall cross any land or property that is not under the same ownership as the premises to which the application refers, then the name and address of the owner of such other land or property must be shown and an indication of the nature of the agreement covering way-leave and right of access for maintenance and repair must be given.

The application accompanying the plans should also give the name and registration number of the licensed plumber who will be responsible for carrying out the work in accordance with the code.

In some cases an application for approval of plumbing proposals may be accepted by the water and sewerage authorities as an application of permission to connect to the main and sewer. In other instances a separate approach is required, and it is essential to make the appropriate procedure clear by reference in the code.

7.3 Setting plumbing standards

There are certain details included in the code that could be regarded as regulations emanating from authorities other than those responsible for plumbing standards. For example, it is usually considered most desirable that individual dwellings should each have a separate connection from the water main and to the public sewer. However, there are occasions, such as when crowded estates or properties remote from public services are dealt with, when this requirement is relaxed. This is usually done with a special agreement whereby those who share a combined service accept responsibility for a proportion of future maintenance costs.

Another detail that should be specifically defined is the boundary between public services and private plumbing. Where water mains and sewers are laid under the public road or street it is common practice for the respective authorities to accept responsibility for the drainpipes and service connections that lie between the boundary of the property to be served and the public main or sewer. Sometimes the authorities concerned install these pipes themselves and charge the applicant for the initial cost; sometimes the licensed plumber makes the connection and lays the pipe, which the authority takes over upon completion; sometimes the water authority provides an underground valve on a service line just within the property boundary, and the owner accepts responsibility beyond that point. In the same way the sewerage authority may construct, or require the construction of, an access chamber on the border between private and public land. These practices may vary in different jurisdictions, but in any case it is essential that the one that is to be adopted should be clearly defined, preferably in the code.

7.4 Quality assurance and testing

Upon approval of the application the authority will issue a permit to undertake the work within a stated time, and specify the tests to be applied to the plumbing system upon completion.

It is the responsibility of the applicant to ensure that the work is executed in accordance with the plans and specifications submitted with the application, and that any conditions attached to the permit are complied with. The authority's inspector will have the right of entry to verify that the terms of the permit are being observed.

Upon completion of the plumbing work, but before the ground has been filled in or the internal pipework hidden by structural features, the applicant should give notice that the system is ready for testing. The form of these tests should either be part of a national code or should be determined by the local authority. Their purpose is to ensure the watertightness of both water piping and the drainage system.

Unless otherwise required by a national code or authority, the water system may be adequately tested by filling the system from the mains and inspecting all joints and fittings for signs of leakage. Some authorities in high-pressure areas may require that the installation be tested by increasing the pressure above the water main pressure. The minimum test pressure of 1.5 times the operating pressure should be used unless the manufacturer's instructions indicate differently. In complex systems the authority may require an air test such as one in which the whole piping system is subjected to a pressure equivalent to 35 kilopascals (kPa) held for a period of at least 15 minutes. Where such tests are to be performed it is usual for the authority to lend or rent the necessary compressor and gauges, and

for the responsible plumber to connect these and set up the test under the direction of the inspector.

Tests on the drainage of the plumbing system are usually applied in sections. Underground drains are commonly given a water test or air test as soon as they are completed. After approval the ground can then be filled in, thus reducing the time that the site is disrupted. The usual procedure is to insert a drain plug in the sewer connection point or the access chamber nearest to the sewer (this may be at the boundary of the property) and to fill the whole of the subsurface drainage system with water. A head of 3 metres maximum to any section of drain may be applied by temporarily adding a short length of vertical pipe at the upper end. It is not always practicable to apply this head, especially if there are a number of gullies in the system, in which case the drains will be filled to the highest point possible and the test applied in sections.

The water should remain in the system for a minimum of 10 minutes for clay drains and 5 minutes for other materials, during which time the water level should not drop significantly. If the joints of the drain are of cement and are dry, the system should be filled at least an hour before the test so that no water is absorbed by the jointing material. If water is scarce, or if for any other reason the authority prefers an air test, the drains should be plugged and subjected to air pressure of 30 kPa for a minimum of 3 minutes without a drop in pressure. Excessive pressures of either water or air are undesirable on underground drain-pipes, which are not designed to resist such internal stresses. The joints (especially cement joints of clay pipes) may also become loosened or damaged if too great a head is applied from within. In such cases the test pressures can be reduced to provide a minimum of 10 kPa or 1 metre head.

As an additional precaution the lower access chamber should be inspected after the water test has been completed and the drains emptied, or after a period of rain, to confirm that there is no infiltration from the surrounding ground into the pipe.

Water tests may be applied to the drain outlets from fixtures within the building by filling the pipes up to the spill level of the fixtures. In multi-storey buildings, a water or air test may need to be done in sections of two storeys. An alternative is a smoke test, in which a machine is used to fill the internal drainage system with smoke under pressure from a testing machine. The vent stack must be plugged at its upper end as soon as the smoke emerges, and the pressure applied should not exceed 250 pascals or the liquid in the fixture traps will be blown out. The pressure should remain steady for at least 15 minutes, during which time all fixtures, traps and pipe joints should be inspected for signs of emerging smoke.

When the whole system has been successfully tested and inspected the authority may issue a certificate to that effect as evidence that the plumber's work has been properly carried out. In some countries it is required that the

plumber issue a compliance certificate indicating that the plumbing and drainage work complies with the regulations and, in effect, the plumber must guarantee the workmanship for a nominated period of time.

7.5 Disinfection of new plumbing installations

Any water used for testing the water piping should be from a safe drinking-water source, and after completion of the test it is good practice for the authority to require that the system be disinfected. One approach is detailed here. Disinfection is normally accomplished by dosing the storage tank with a chlorine compound (e.g. sodium hypochlorite or calcium hypochlorite) to produce a 20–50 milligrams per litre solution of free residual chlorine, running all taps and fixtures until the smell of chlorine is evident at all outlets, then closing all taps and fixtures and allowing the system to stand for an appropriate period (from at least one hour at 50 milligrams per litre to at least two hours at 20 milligrams per litre). It is then flushed to waste until the chlorine levels of the emerging water decrease to normal values. Other approved disinfectants may be used, for example appropriate concentrations of chlorine dioxide, but it is more difficult to obtain and handle than chlorine (bleach or bleaching powder). Of course, it is essential that the gaskets and fittings and other materials in the plumbing system have been selected to be resistant to damage from the chlorine or other disinfectant at the doses that would be used.

When disinfecting the system after installation, or when putting a system back into service after a serious contamination incident, it is necessary to calculate the approximate quantity of disinfectant to be used. This depends upon three factors – the volume of water contained in the system while no draw-off is taking place, the percentage of free chlorine (or other disinfectant) in the compound chosen and the chlorine demand of the water.

The cubic capacity of the pipework can readily be obtained by measuring the lengths of pipe of different diameters and multiplying by their cross-sectional areas. To calculate the figure accurately is a laborious process, and it is more practical to make a generous estimate since the disinfectant solution can be somewhat overstrong, but should not be weaker than specified. To the pipework capacity must be added the volume of the supply cistern and any flush tanks connected to the system. However, it is important to strive to achieve a relatively accurate calculation so excessive deterioration of fittings or other problems are avoided. Manufacturers' instructions should always be followed.

To obtain a 50 parts per million solution, 50 grams of free chlorine per 1000 litres (7 ounces per 1000 US gallons; 8 ounces per 1000 UK gallons)¹ will be

¹ Conversions: 1 ounce = 28.35 grams, 1 pound (lb) = 0.45 kilograms, 1 US gallon = 3.79 litres, 1 UK gallon = 4.55 litres.

needed.¹ The strength of the compound to be used (whether solid or liquid) should be known and the quantities adjusted according to the percentage of free chlorine. If, for example, a bleaching powder of 25% available chlorine is the agent chosen, 200 grams of the compound will be required per 1000 litres of solution (1.7 lb per 1000 US gallons; 2 lb per 1000 UK gallons). If the compound is in solid form it will be expedient to dissolve it immediately before use (Taylor & Wood 1982; IPHE 2004). Use the supernatant liquid.

Before dosing begins, all pipework should be flushed out, the incoming mains supply shut off and the system emptied by opening valves on all fixtures. The dead space in the supply tank below the lowest draw-off point should be emptied and cleaned out. Prior to emptying the plumbing system, all of the occupants of the building should be notified of the expected length of interruption of supply so that water for use during that period may be drawn off and stored. They must also be warned against using any flush tank or other fixture while disinfection is taking place.

With all fixture taps closed, water from the main is readmitted to the storage tank and the prepared disinfectant gradually added to the incoming supply close to the ball valve to ensure thorough mixing. Most, but not all, of the disinfectant should be added in this way until the tank is full. Water should then be drawn off from each fixture in turn until chlorine (as evidenced by the smell) emerges, after which the fixture taps are shut and left undisturbed for the required time. Flush tanks should be operated until the water they contain is chlorinated. The supply tank should then be topped up (using the remainder of the concentrated disinfectant) and the incoming supply shut off once more.

At the end of the contact period the system is once more emptied through the fixtures, mains water is readmitted to the supply tank, and fixtures such as sink or washbasin taps are opened and allowed to run until chlorine cannot be smelled. Analytical test systems are readily available to test for residual chlorine. This is unnecessary for water closets or other fixtures where the water will not be drunk or come into contact with the skin.

In buildings where no supply tank is installed and fixtures are supplied directly from mains pressure the procedure is more complex, calling for the use of a force pump, and this might be carried out by the public authorities, or according to their special requirements.

More elaborate disinfecting procedures may be required for complex systems, and for periodic maintenance of piping and storage tanks in buildings serving special purposes, for example hospitals, boarding schools, residential hotels and

¹ As plumbing in many countries still uses non-metric measures for fixtures and fittings and their use, non-metric equivalents to standard SI units are given, where appropriate, in this book. These equivalents may be rounded off, according to requirements in each instance.

food establishments. The authority may require a bacteriological test (*E. coli* or faecal coliforms) of the water in the system after disinfection of the plumbing system has been carried out. After any disinfection procedure is carried out, the contractor should issue a certificate of conformity.