

# Chapter I

## Basic Plumbing Installation Principles

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The majority of state plumbing codes and licensing examinations are designed to establish environmental sanitation and safety through properly designed supervision that will ensure properly installed and maintained plumbing systems. Details of plumbing construction vary, but the basic sanitary and safety principles are the same. The desired and required results (to protect the health of people) are similar regardless of locality. These basic principles require that all plumbing in public and private buildings intended for human occupation or use be installed so as to protect the health, welfare, and safety of the occupants and the public.

These basic principles include the following:

- Buildings intended for human occupancy or use will be provided with a supply of pure and wholesome water with connections not subjected to the hazards of backflow or back siphonage and not connected to unsafe water supplies. If there is a public water main available, an individual connection to the public water main shall be made.
- Buildings with plumbing fixtures and devices shall be provided with a supply of water in sufficient volume and pressure to enable them to operate in a satisfactory manner at all times.
- Water heaters and other devices used for purposes of water heating and storing shall be designed and installed to prevent explosion through overheating.
- Where public sanitary sewers are available, buildings intended for human occupancy shall have a connection made to the public sanitary sewer.
- Plumbing fixtures shall be made of materials that are durable, corrosion-resistant, nonabsorbent, and free of concealed fouling surfaces. Rooms in which water closets, urinals, and similar fixtures are installed shall have proper ventilation and adequate lighting.
- It is recommended that family dwelling units adjacent to sanitary sewer lines or having private sewage disposal systems have at least one lavatory, one water closet, a bathtub or shower, and a kitchen-type sink for purposes of sanitation and personal hygiene. Other structures for human occupancy with sanitary

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public or private sewage-disposal systems should have no less than one water closet and one fixture for hand-washing.

- Building sanitary drainage systems shall be designed, installed, and maintained in a condition so as to conduct wastewater and sewage to designated locations from each fixture with a flow that prevents fouling, clogging, and deposits of solids in the piping. Sufficient cleanout shall be installed so that the piping system can be easily cleaned in case of stoppage.
- Plumbing systems shall be maintained in a sanitary condition, and each connection (direct or indirect) to the drainage system shall have a water-seal trap. The system shall be kept in a serviceable condition with adequate spacing of the fixtures. These fixtures should be reasonably accessible for cleaning.
- Drainage pipe shall be designed and installed with a durable material free of water leakage and offensive odors caused by drain sewer air. Installation shall be in accordance with good workmanship practices and use of good grade material.
- Plumbing systems shall be designed, installed, and kept in adjustment so as to provide the required quantity of water consistent with adequate performance. There should be no undue noise under normal conditions and use. New systems and/or remodeled systems shall be subjected to tests that will disclose leaks and defects.
- Included in the design shall be every consideration for the preservation of the strength of structural members of the building. Each vent terminal extending to the outer air shall be designed to minimize clogging and return of foul air to the building.
- Design considerations shall include protection from contamination by sewage backflow of water, food, disposal of sterilized items, and similar materials. Substances that will clog pipes or their joints and interfere with the sewage disposal process or produce explosive mixtures shall not be allowed in the building sewage drainage system.
- Sewage or other wastes from a plumbing system shall not discharge into subsurface soil or into a water surface unless it has first been treated in an acceptable manner.

The following are typical questions asked in reference to basic plumbing and installation principles in plumbing licensing examinations.

**1-1 What is the BOCA?**

BOCA is an acronym for Building Officials and Code Administration or the *Basic Plumbing Code*.

**1-2 What are the seven classifications of pipe materials contained in the BOCA code?**

The seven classifications are as follows:

- **Water service pipe.** This type of pipe may be made of asbestos cement, brass, cast iron, copper, plastic, galvanized iron, or steel.
- **Water distribution pipe.** This type of pipe may be made of brass, copper, plastic, or galvanized steel.
- **Aboveground drainage and vent pipe.** This type of pipe may be made of brass, cast iron, copper (type K, L, M, or DWV), galvanized steel, or plastic.
- **Underground drainage and vent pipe.** This type of pipe can be made of brass, cast iron, copper (type K, L, M, or DWV), galvanized steel, or plastic.
- **Building sewer pipe.** This type of pipe may be made of asbestos cement, bituminized fiber, cast iron, copper (type K or L), concrete, plastic, or vitrified clay.
- **Building storm sewer pipe.** This type of pipe may be made of asbestos cement, bituminized fiber, cast iron, concrete, copper (type K, L, M, or DWV), or vitrified tile.
- **Subsoil drainpipe.** This type of pipe may be made of asbestos cement, bituminized fiber, cast iron, plastic, styrene rubber, or vitrified clay.

**1-3 What are the six types of corrosion of which a plumber should have knowledge?**

The six types of corrosion are as follows:

- **Concentrated cell corrosion.** This is an electrical effect caused by differences in composition of a solution in contact with a single metal or alloy.
- **Dezincification corrosion.** This form of corrosion usually occurs with alloys of copper and zinc in which the zinc content is more than 15 percent. The zinc is chemically leached out of the copper-zinc compound.
- **Graphite-type corrosion.** This type of corrosion is commonly related to cast iron and resembles zincification. It means that

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the iron in the gray cast iron may be leached out. This leaves behind a porous layer of graphite over the remaining unattacked iron.

- **Stress-accelerated corrosion.** Under high stress, some of the yellow brass alloys may have a quantity of metal dissolve and create a mechanical weakening in the material.
- **Galvanic corrosion.** This corrosion is created by various sources creating electrochemical rather than electrical differences. This occurs when there are two dissimilar metals making contact with a solution *covering* the area.
- **Pitting and local corrosion.** This type of corrosion usually occurs when there is a breakdown in the passive films that a metal or alloy builds up in a corroding solution. This may also occur as a result of accelerated corrosion. This may have a surface blemish or nonmetallic inclusion.

### Multiple-Choice Exercises

Select the right answer and blacken *a*, *b*, *c*, or *d* on your practice answer sheet. (See Appendix C for answers.)

1. Water service pipe is classified into seven groups. Which of the following is not one of them?
  - a. Asbestos cement
  - b. Copper
  - c. Plastic
  - d. Lead
2. Water distribution pipe is classified into four categories. Which of the following is *not* one of them?
  - a. Lead
  - b. Copper
  - c. Plastic
  - d. Brass
3. What is the BOCA?
  - a. British Overseas Aircraft Company
  - b. Broadband on all cars
  - c. Building Officials and Code Administration
  - d. Building Offices and Code Alterations

4. The drainage of sewage and wastes from a plumbing system shall not be discharged into subsurface soil or into a water surface unless which of the following occurs?
  - a. It has been properly treated.
  - b. It meets the Clean Water Act's guidelines.
  - c. Environmental officials approve.
  - d. It is cleaner than when it was first used.
5. Which of the following is a type of corrosion that a plumber should know about?
  - a. Concentrated cell corrosion
  - b. Acid corrosion
  - c. Degenerative corrosion
  - d. Just plain corrosion
6. Copper pipe is classified into four categories. Which of these is not one of them?
  - a. K
  - b. L
  - c. DWV
  - d. N
7. Underground drainage and vent pipe can be made of which of the following?
  - a. Brass
  - b. Cast iron
  - c. Concrete
  - d. Plastic
8. Buildings with plumbing fixtures and devices shall be provided with a supply of water in sufficient volume and \_\_\_\_\_ to enable them to operate in a satisfactory manner at all times.
  - a. pressure
  - b. quantity
  - c. quality
  - d. velocity

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9. Galvanic action/galvanic corrosion is caused by which of the following?
- The galvanizing action during the application of a zinc coating of steel.
  - The plating action of unlike metals.
  - Two dissimilar metals coming in contact with a liquid or electrolyte covering them.
  - Two acids and galvanic steel being mixed.
10. Sewage or other wastes from a plumbing system shall not be discharged into subsurface soil or into a water \_\_\_\_\_ unless it has first been properly treated.
- surface
  - hole
  - pond
  - river
11. Buildings with plumbing fixtures and devices shall be provided with a supply of water in sufficient volume and \_\_\_\_\_ to enable them to operate in a satisfactory manner at all times.
- pressure
  - quantity
  - quality
  - velocity