Unit 4

Installation of Basic Sanitary Fittings and Fixtures

Introduction

You must have seen plumbing and sanitary fittings and fixtures installed in the kitchen, bathroom or toilets of your home, school or other buildings. Many people confuse the words plumbing fittings and plumbing fixtures. A plumbing fixture is a part that is connected to a plumbing system and carries water through a building. The most common plumbing fixtures are bathtubs, sinks, showers, tubs, toilets and faucets. While a fixture can be fixed into walls or the floor, a fitting is an item that can be hung by a hook, screw or nail.

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Plumbing fittings

Various types of pipe fitting are available in plumbing systems for different purposes and functions. A pipe fitting is used in the plumbing system to join multiple pipes of same size or different sizes, to regulate the flow or to measure the flow. They are made, up of different materials like copper, iron, brass, PVC, etc.

There are many different kinds of fittings, made from a variety of materials. Some of the most common types are as follows.

Types of fittings

1. Collar
2. Elbow
3. Gasket
4. Union
5. Reducer
6. Tee
7. Nipple
8. Trap

For a building, the plumbing system should be designed in a way that water is distributed uniformly, throughout the day. It should be ensured that a combination of fittings and fixtures is selected in such a way that uniform supply of water and discharge of water is maintained.

Fig. 4.1: Collars

Collar

While joining two pipes in the same length, collar is used. It is fitted at the end of the pipe (Fig. 4.1).

Elbow

It is installed at the time of joining two pipes. With the help of an elbow, the direction of liquid is changed. Normally a 45 degree or 90 degree elbow is used. When the two sides of pipes differ in size, an elbow of reducing size is used. This is called reducing type elbow or reducer type elbow.
Elbows are categorised as follows.

Long Radius (LR) elbows

Here, the radius is 1.5 times the diameter of pipe.

Short Radius (SR) elbows

In this, the radius is 1.0 times the diameter of pipe.

45-degree elbow

This is used when the change in direction required is 45 degrees (Fig. 4.2).

90-degree elbow

This is used when the change in direction required is 90 degrees (Fig. 4.3).

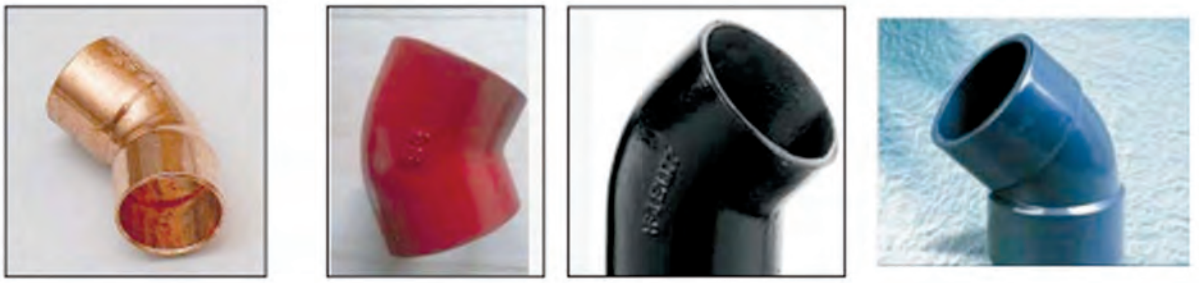

Fig. 4.2: Bend 45 degree

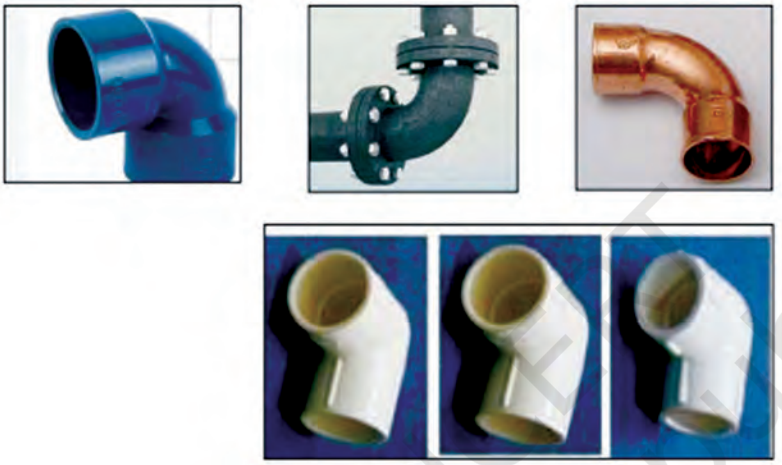

Fig. 4.3: Bend 90 degree

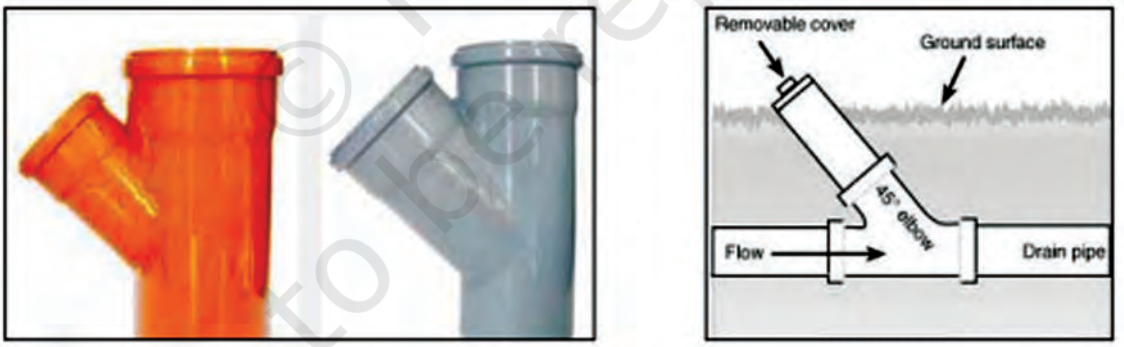

Fig. 4.4: Y-T joint

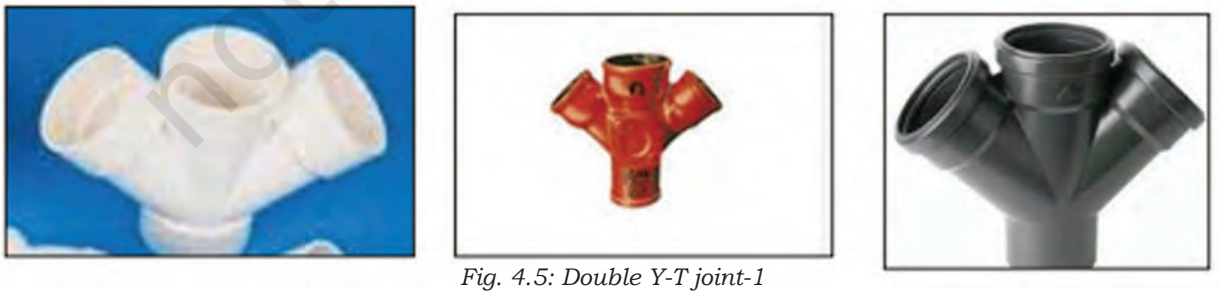

Fig. 4.5: Double Y-T joint-1

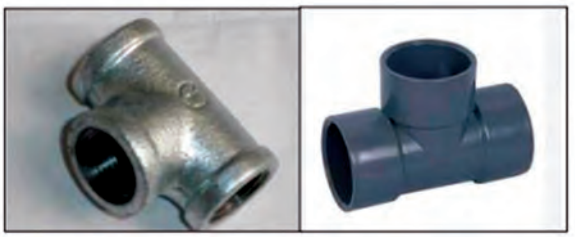

Fig. 4.6: Double Y-T joint-2

Fig. 4.7: T-trap

Gasket

Fig. 4.8: Gasket

They are mechanical seals, generally ring-shaped and fitted for sealing flange joints. A flange joint is a plate or ring to form a rim at the end of a pipe when fastened to the pipe. Gaskets are made as per by construction, materials and features. Important gaskets used are non-metallic, spiral-wound and ring-joint type (Fig. 4.8).

Union

Fig. 4.9: Union

When two ends of pipes are joined, the pipe fitting used is called a union. A union is made of three parts, namely a nut, a male end and a female end. The male and female ends are assembled with the support of the nuts, and necessary pressure is applied to connect the joint. Since the pairing ends of the union are interchangeable, the union can be changed easily in a short time (Fig. 4.9).

Reducer

It is used to connect pipes of different diameters. A reducer may be of various types like reducer tee, reducer elbow and reducer socket (Fig. 4.10).

Fig. 4.10: Reducers

Tee

It is an important fitting with a side outlet at 90^0 to the run of the pipe. Tees connect pipes of various diameters and help in changing the direction of water or material in a pipe. Tees are made in various sizes like equal or unequal. The equal tee is most commonly used (Figs. 4.11–4.13).

Fig. 4.11: Single tee socket

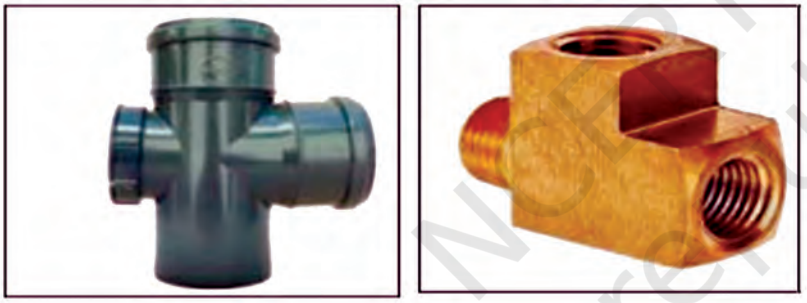

Fig. 4.12: Single tee socket

Fig. 4.13: Double tee socket

Nipple

It is a piece of pipe having thread at both sides, and could be used for short extension of plumbing lines. It can also be used for connecting two fittings within small distance (Fig. 4.14).

Fig. 4.14: Nipple

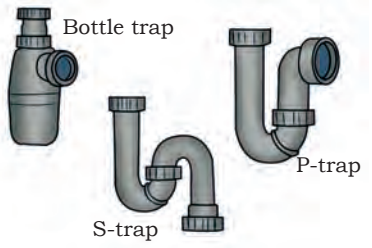

Fig. 4.15: Trap

Trap

It is a fitting in a P-, U-, S- or J-shaped type (Fig. 4.15). Traps are fitted near a plumbing fixture. The trap bend is fitted to prevent sewer gases from entering the building. If the gases are inserted back into home, then it could lead to people inhaling foul smell, which could cause illnesses. It could even explode.


Fig. 4.16: Cross

Cross

When four pipes are joined, a cross is formed. It is also called a cross branch line or a four-way fitting (Fig. 4.16). This fitting has three outlets and one inlet. Cross fittings may deteriorate when temperatures change, because cross fitting is made at the centre of the four connection points.


Fig. 4.17: Offset

Offset

When an assembly of fittings on a pipeline makes one section of pipe out of line and parallel to a second section, then it is known as an offset (Fig. 4.17).

Common sanitary fittings and fixtures

Bathtub

Installed in a bathroom, it is made of vitreous material, enamelled iron, plastic, marble, etc. Its length varies from 1.7 m to 1.85 m, the width is 70 cm×75 cm and the depth varies from 43 cm to 45 cm to the outlet end. Cold and hot water taps are provided for filling the tank, and an overflow pipe is provided for excess water drainage. A waste coupling with a waste seal trap is provided at the drain with a rubber plug as in the washbasin.


Fig. 4.18: Bathtub

Washbasin

It is provided for washing hands, face, etc. These are generally made of vitreous china, burnt fireclay, ceramic, enamel over steel, marble, glass, etc. Washbasins are available in different shapes, sizes and colours.


Fig. 4.19: Washbasin

Water closet

It is provided to receive human excreta directly from the user. It is connected through a suitable trap to the soil pipe and finally to a municipal sewer or septic tank. The excreta is flushed with the help of water from the cistern tank. There are two types of water closets.

1. Indian type
2. European type

Fig. 4.20: Water closet

Faucet

It is a device that controls the flow of liquid, especially water, from a pipe. It is also called a water tap. It is available in a bathroom, kitchen or sink, as per use.

Fig. 4.21: Faucet

Fig. 4.22: Sink

Sink

It is a rectangular, shallow, waterproof tank made of concrete, vitreous china, fireclay, or stainless steel. It is used for cleaning utensils, clothes, etc. The flow of a sink is provided with a hole for fixing a waste coupling and a waste pipe.

Fig. 4.23: Flushing cistern

Flushing cistern

It is a small tank holding water for flushing urinals and water closets. It is made of cast iron, glazed earthenware, glazed vitreous, or any other material. Depending upon its size, a cistern can hold the following quantities of water—5 litres, 10 litres and 15 litres. A 10-litre cistern is the most common.

Geyser

It is used for heating water. It is available in different capacities, upto 25 litres, as per requirement.

Fig. 4.24: Geyser

Installation

It refers to the act of placing or fixing in position a plumbing fixture such as a washbasin, a water closet, etc. Installation is an important step in fixing the components of a system as per the design. During the installation of plumbing system in a building, home or a housing colony, planning is done as per the standard procedure of designing. A good installation system prevents water leakage, allows optimum installation of the money spent and enhances the life of the plumbing fixtures. Instructions for installation are given either by the manufacturer on one's own or the specifications in the construction map.

If the standard procedure is followed during the installation of plumbing system, it allows for smooth and efficient functioning of the system.

Important points before installation

Read the plumbing drawing

Study the drawing of the bathroom, washroom, kitchen or other places where installation is to be done. The drawing will help the Plumber General to understand various aspects of plumbing fittings, fixtures, distance and height to be maintained during installation.

Install the basic sanitary fixture

Fittings (faucets and valves) are used more often than any other part of the plumbing system. The best modern fittings selected should use chrome-plated brass as it

bears the effect of water quality and has a high durability. They can be cleaned easily with soap and warm water.

Protection against backflow

The supply lines and fittings for every plumbing fixture should be installed in such a way that there is no backflow. There may be a backflow due to improper design.

Access for cleaning

Plumbing fixtures should be installed in such a way that they can have easy access for cleaning, for both the fixture and the area around the fixture.

Check for alignment and setting

The fixtures must be set level in proper alignment with the adjacent walls. As per the Indian Plumbing Association Code, a water closet, lavatory or bidet should not be set closer than 15 inches (381 mm) from its centre to any sidewall, partition, vanity or other obstruction, or closer than 30 inches (762 mm) centre-to-centre between toilets or adjacent fixtures. An 18-inch (457 mm) distance must be in front of the water closet or bidet to any wall, fixture or door. Water closet compartments should not be less than 30 inches (762 mm) wide and 60 inches (1524 mm) deep. There must be at least 18 inches (457 mm) clearance in front of a lavatory to any wall, fixture or door. A urinal shall not be set closer than 15 inches (381 mm) from the centre of the urinal to any sidewall, partition, vanity or other obstruction, or closer than 30 inches (762 mm) centre-to-centre between urinals.

Make floor and wall drainage connections

Connections between the drain and floor outlet plumbing fixtures must be made with a floor flange. The flange shall be attached to the drain and anchored to the structure. Connections between the drain and wall-hung water closets should be made with an approved extension nipple or horn adapter. The water closet must be bolted to the hanger with corrosion-resistant bolts or screws. Joints should be sealed with an approved elastomeric gasket or setting compound.

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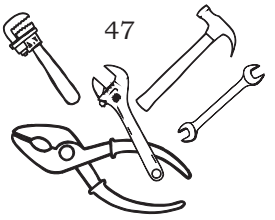


Check for floor flanges

Floor flanges for water closets or similar fixtures shall not be less than 1/8 inch (3.2 mm) thick for brass, 1/4 inch (6.4 mm) thick for plastic, and not less than a 2-inch (51 mm) caulking depth for cast-iron or galvanised malleable iron. Floor flanges of hard lead shall weigh not less than 0.7 kg and shall be composed of lead alloy with not less than 7.75 percent antimony (a chemical element which is a brittle, silvery-white metalloid) by weight. Closet screws and bolts shall be of brass. Flanges shall be secured to the building structure with corrosion-resistant screws or bolts.

Secure floor outlet fixtures

Floor outlet fixtures must be secured to the floor or floor flanges by screws or bolts of corrosion-resistant material.

Secure wall-hung water closet bowls

Wall-hung water closet bowls should be supported by a concealed metal carrier that is attached to building the structural members so that strain is not transmitted to the closet connector or any other part of the plumbing system.

Make water-tight joints

All the joints of fixtures close to the wall or floor must be sealed to prevent water from entering or passing through.

Plumbing in mental health centres

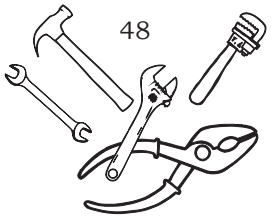
In mental health centres, pipes or traps should not be exposed, and fixtures must be bolted through walls.

Design of overflows

Where any fixture is provided with an overflow, the waste should be designed and installed in such a way that standing water in the fixture will not rise in the overflow when the stopper is closed, and no water will remain in the overflow when the fixture is empty.

Connection of overflows

The overflow from any fixture should be discharged into the drainage system on the inlet or fixture side of the



trap. The only exception exists in case of the overflow from a flush tank serving a water closet or urinal, which should be discharged into the fixture served.

Access to concealed connections

Fixtures with concealed slip-joint connections should be provided with an access panel or utility space at least 12 inches (305 mm) in its smallest dimension or other approved arrangement so as to provide access to the slip connections for inspection and repair. Where such access cannot be provided, access doors shall not be required, provided that all joints are soldered, solvent cemented or screwed so as to form a solid connection.

Installation of a wall hung fixture

Step 1. Install the mounting board between the studs at the proper height, using the same method as for a wall-hung flush tank.

Step 2. Attach a hanger bracket on the finished wall using the proper length of wood screws at the recommended height. The metal bracket must be level.

Step 3. Place the lavatory on the bracket and push down. Make sure the lavatory is level.

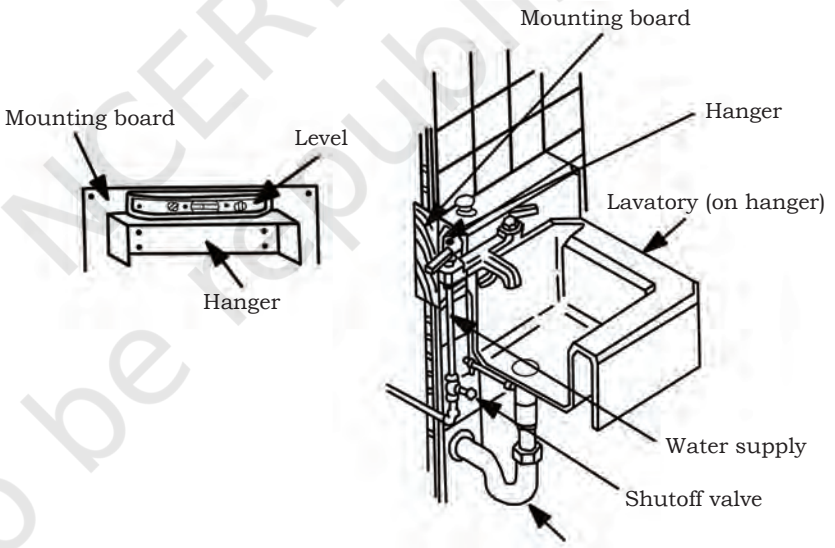


Fig. 4.25: Wall-hung lavatory installation

Joining of pipes

Proper solvent cementing techniques are fundamental to the successful installation of pipes. Such techniques provide the basis for strong and durable solvent cement joints.

Solvent cementing

Also known as solvent welding, solvent cementing is a chemical process that uses a primer, or the

cement itself, to soften the surface of a plastic pipe and fittings in order to weld, or fuse them together. When applied, the solvents soften and dissolve the top layer of the pipe and fitting material, loosening its molecular structure. A taper in the fitting socket creates an interference fit that ensures contact between the pipe and fitting. This allows the material to fuse to itself when the two pieces are connected. Solvent cementing is a fast, easy and highly reliable process that produces a joint, stronger than either the pipe or fitting alone.

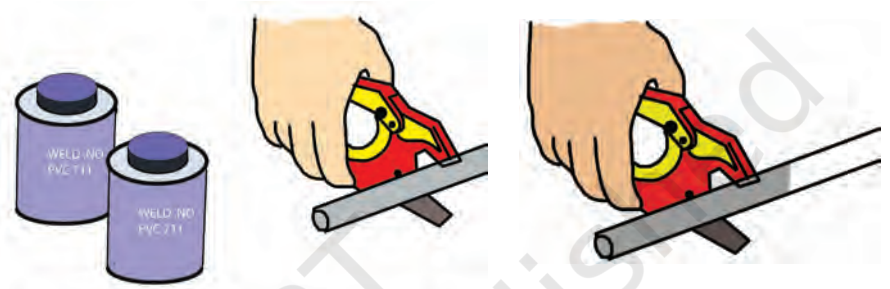


Fig. 4.26: Solvent cementing is the most popular kind of Chlorinated Polyyvinyl Chloride joining method

PVC glue is used as a solvent cement. It is an adhesive that is used to create an airtight seal that holds the PVC pipe and connection fittings together. Considering that the majority of piping installation failures are the result of improper cementing techniques, an understanding of the proper techniques required for joining, saves both time and money.

Procedure for solvent cementing

1. Inspect the pipe and fittings for overall appearance and compatibility. Obvious defects such as cracks, burrs and incompatible materials must be addressed as required. The joining surfaces must be clean and dry. In addition, the cement for the type and size of pipe and fittings should be determined. Also, remember both temperature and humidity may be issues to consider. Another detail that is often overlooked is the need to have the correct size applicator for the size of pipe. The size of the applicator should be about half the size

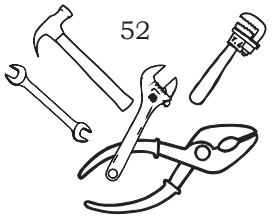
of the pipe diameter in order to ensure proper and timely solvent cement coverage.

2. Cut the pipe with a cutter or saw in square to provide optimal bonding area. See Fig. 4.26.
3. De-burr the pipe with a chamfering tool or file to ensure proper contact between pipe and fitting. Remove all burrs from both the inside and outside of the pipe with a knife, file or reamer. Burrs can scrape channels into pre-softened surfaces or create hang-ups inside surface walls. Remove dirt, grease and moisture. A thorough wipe with a clean dry rag is usually sufficient.
4. Apply a heavy, even coat of CPVC primer (if necessary) to the fitting. Use the right applicator for the size of pipe or fittings being joined. The applicator size should be equal to 1/2 the pipe diameter. It is important that a satisfactory size applicator be used to help ensure that sufficient layers of cement are applied.
5. Apply a heavy, even coat of primer (if necessary) to the pipe end. The purpose of a primer is to pierce through and soften the surfaces so they can fuse together. The proper use of a primer and checking its softening effect provides assurance that the surfaces are prepared for fusion in a wide variety of conditions. Check the piercing or softening on a piece of scrap before you start the installation or if the weather changes during the day. Using a knife or other sharp object, drag the edge over the coated surface.

   Proper piercing has been made if you can scratch or scrape a few thousandths of the primed surfaces away. Because weather conditions do affect priming and cementing action, repeated applications to either or both surfaces may be necessary. In cold weather, more time is required.

Fig. 4.27: Joining of elbow after application of solvent

6. Apply a heavy, even coat of CPVC cement (if necessary) to the fitting. Then apply to the pipe-end. Stir the cement or shake can before using. Using the proper size applicator for the pipe size, aggressively work a full even layer of cement onto the pipe-end equal to the depth of the fitting socket. Do not brush it out to a thin paint type layer, as this will dry within a few seconds.
7. Insert the pipe into the fitting socket, rotating ¼ to ½ turn. Hold the pipe for 10 seconds, allowing the joint to set. A merit of using plastic pipes is that if you make a mistake, you can cut the section out and re-do it.
8. The joining is finished. The cure (drying) time depends on pipe size, temperature and relative humidity. If local codes permit, successful joints can be made without a primer using cement alone, but extra care must be taken during the installation. It is important that a good interference fit exists between the pipe and fittings. It is for this reason that we recommend that joints being made without a primer be limited to systems 2" and smaller for pressure applications (water systems only) or 6" and smaller for drain waste vent (DWV) or non-pressure applications. Extra care must also be taken in applying the cement to make sure proper piercing (insertion) and softening of the pipe and fitting surfaces is achieved.
9. Joint strength develops as the cement dries. In the tight part of the joint, the surfaces will tend to fuse together; in the loose part, the cement will bond to both surfaces. These areas must be softened and pierced through. Piercing and softening can be achieved by the cement itself, by using a suitable primer or by the use of both primer and cement. For certain materials and in certain situations, it is necessary to use a primer. A suitable primer will usually slip into and soften the surfaces more quickly than cement alone.



Practical Exercises

Activity 1

Visit a local sanitary shop and identify various types of plumbing fixture.

Material required

1. Pen
2. Pencil
3. File

Procedure

1. Visit a sanitary store.
2. Identify various plumbing fixtures available there and make a list.
3. Ask for the price and technical details (size, capacity, make) of the fixtures and note down in your file.
4. Collect pamphlets of the same, if available.

Activity 2

Practise joining pipes using plumbing tools.

Material required

1. Joints
2. Pipe
3. Tools—hacksaw, cutter, brush, clamp
4. Adhesive

Procedure

1. Collect the pipe joints, pipes and tools—hacksaw, cutter, brush and clamp.
2. Identify the parts to be joined.
3. Collect the joints.
4. Join the pipe with help of a pipe jointing adhesive.

Activity 3

Identify the various fixtures and fittings used in the bathroom and toilet.

Material required

1. Pen
2. Pencil
3. File

Procedure

1. Go to your bathroom and toilet.
2. Identify the fixtures and fittings used there.
3. Make a list of these in your practical file.

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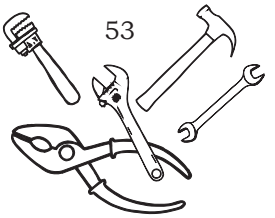

Check Your Progress

A. Answer the following questions

1. Explain the different fittings and its uses in the plumbing system.
2. Enlist the different fixtures and its uses in the plumbing system.
3. Write the important steps for the installation of plumbing fixtures.
4. Explain the procedure of pipe joining.

B. Fill in the blanks

1. Water closet, lavatory or bidet shall not be set closer than_____ inches.
2. Closet screws and bolts shall be of made of _____.
3. _____should be accomplished by using a file or a chamfering tool.
4. The supply lines and fittings for every plumbing fixture shall be installed so as to prevent_____.

C. Multiple choice questions

1. A good installation system
   (a) prevents water leakage
   (b) allows the optimum utilisation of the money spent
   (c) enhances the life of the plumbing fixtures
   (d) All of the above
2. The length of a bathtub varies from _____.
   (a) 1.7 m to 1.85 m
   (b) 1.0 m to 1.15 m
   (c) 1.2 m to 2.0 m
   (d) 1.5 m to 1.8 m
3. The full form of CPVC is
   (a) Chlorinated Polyvinyl Chloride
   (b) Chlorinated Pipevinyl Chloride
   (c) Chlorinated Polyvinyl Chlorine
   (d) Chemical Polyvinyl Chloride
4. Geyser is used for
   (a) heating the water
   (b) cooling the water
   (c) storing the water
   (d) None of these