Facility Maintenance on Plumbing Work

Learning Guide

Unit of Competence:

Install, Service, and Maintain of Building Plumbing Systems and Components

Module Title:

Install, Service, and Maintain of Building Plumbing Systems and Components

LG Code: CON SIW

TTLM Code: CON SIW2 TTLM

Instruction Sheet-1	General Introduction

1. GENERAL INTRODUCTION

1.1 Learning Guide

This learning guide is developed to provide you the necessary information regarding the following unit of competencies:–

- ✓ Prepare for work
- ✓ Determine installation requirements
- ✓ Install sanitary drainage systems
- ✓ Carry out the service and maintenance of drainage systems and components
- ✓ Locate, check, clear and maintain blockage, Leakage, Broken, Loosen, Smell odor, and damaged.
- ✓ Clean up

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to

- Read and interpret plan/working drawings
- Know Applying OHS and requirements
- Identify Planning and sequencing Tasks
- Identify Quality assurance requirements
- Know Selecting tools and equipment, including personal safety equipment
- Determine position of installation
- Calculate Quantity and type of materials
- Mark out Size and location damage
- Install drainage systems and components
- Know Installing pipe work
- Identify Repairing connections
- Know Checking installation
- Know testing installation

- Know Carrying out service and maintenance activities
- Know Servicing and maintaining system components
- Know Locating and isolating section containing blockage, leakage, broken, loosen, smell odor, and damaged.
- Select blockage, leakage, broken, loosen, smell odor, and damaged clearing equipment
- Clear blockage, leakage, broken, loosens, smell odor, and damaged.
- Test pipe and fixtures
- Dispose and recycling waste materials
- Know repairing damaged areas

1.2 Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the "Information Sheets". Try to understand what are being discussed.
4. Accomplish the "Self-checks", in each information sheets.
5. After you accomplish Operation sheets ensure you have a formative assessment and get a satisfactory result;
6. Then proceed to the next information sheet.

Reading and interpreting plan/working drawings

Working drawings are the set of drawings associated with a construction project, and can include plans, elevations, sections, details or any other drawings that give information about the project. Abbreviations and symbols, for the purpose of this unit standard, means abbreviations and symbols that would appear on a basic single-level house plan.

The first thing that a technician should understand the plumbing plans is important. The major systems found in a complete plumbing plan are sanitary drainage system, plumbing vent system,

domestic hot and cold water system, roof drainage system, fire protection sprinkler system, and compressed air system.

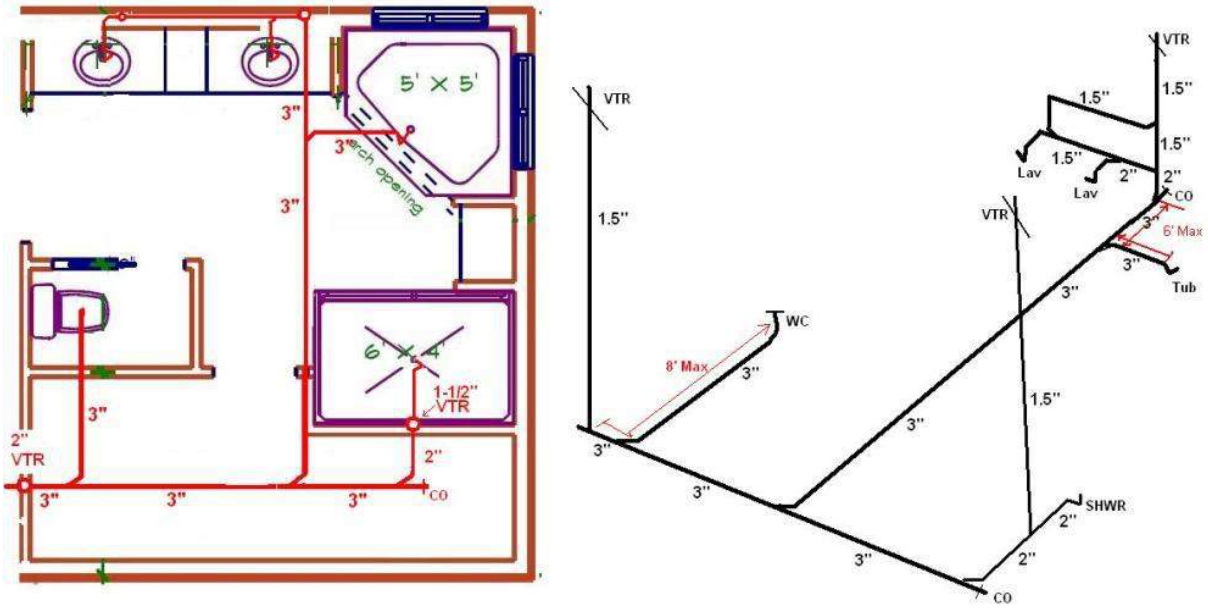


Figure 1.1 Sample of plane that show symbols

Looking for Specific Systems

On the plan, the size and location of each piping system is shown. The domestic cold and heat water piping includes the service piping to the building and the distribution piping inside the building. The heavier lines represent the drain lines. The lines connected to the plumbing fixtures are the sanitary waste lines. The sanitary piping is located underground except for the part that turns up to connect to the plumbing fixtures. The roof drainage piping is connected to the roof drains, usually installed above the ceiling and below the roof. The lines are drawn as a sanitary line and identified as storm drain lines because they are connected to the roof drains. The other piping system is the plumbing vent piping. This piping is connected above the trap on each fixture to let air enter and leave the piping system when water is introduced into the drainage system.

1.3 Reading the Plumbing Plans

The floor plan shows the location of the plumbing fixtures, and the fixtures are numbered to corresponding to the Plumbing Fixture Schedule. The schedule has the name of the fixtures, the manufacturer and model number of each fixture, and the connection size for all the piping connected to the fixture. There is a space for notes that pertain to the fixtures. The domestic cold

water piping is shown with a light solid line having long dashes and a dot. The domestic hot water is shown with the same weight line as the domestic cold water lines except that the line is a series of long dashes with two dots. These piping systems have all the fittings and valves needed for a complete system.

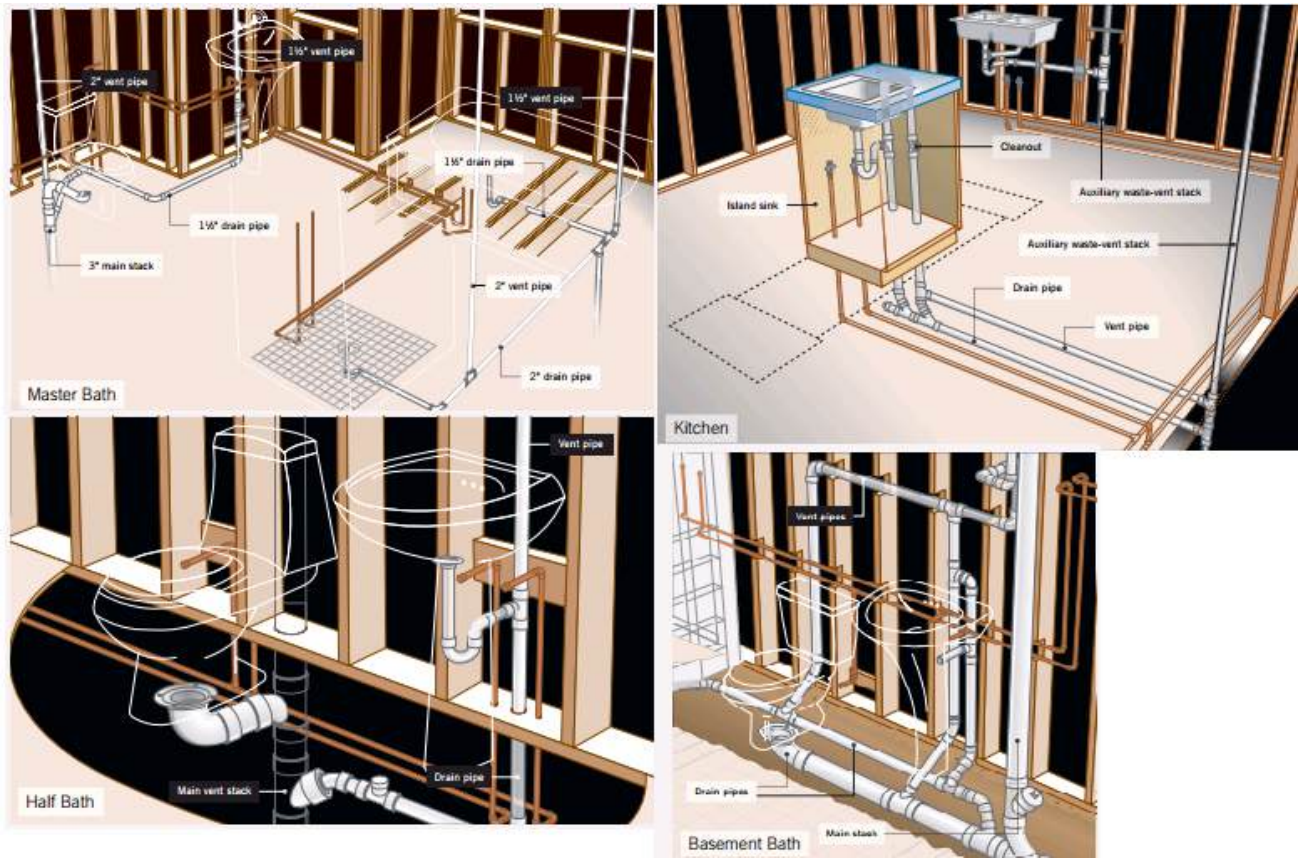


Figure 1.2 Observation and imagination of technician on plane

1.4 Applying OHS Requirements

OHS practices must include to identification and control hazard risk assessment and implementation of risk reduction measures specific to the tasks described by this unit and may include:

- Manual handling techniques
- Standard operating procedures
- Personal protective equipment
- Safe materials handling

- Taking of rest breaks
- Ergonomic arrangement of workplaces
- Following marked walkways
- Safe storage of equipment
- Housekeeping
- Reporting accidents and incidents
- Other OHS practices relevant to the job and enterprise

1.4.1 Safety Requirements

Health and Safety safe work practices and procedures, and creating an understanding of the requirement are essential.

It is essential that you need to address the following before, during, and after an activity:

- The instruction sequenced progressively to ensure safety
- Identify the specific instruction the way use and handle equipment and tools correctly
- Analyze the specific instruction use, handle, and dispose of hazardous materials
- Identify the in readiness and appropriateness of tools and equipment before you start work

The following are lists that guide the learner to establish a safe environment. Learner should:

- Wear appropriate attire and safety equipment
- Follow established rules and routines
- Select tasks that are within your abilities
- Show self-respect for the safety
- Recognize hazards in work areas
- Use safety tools during plumbing

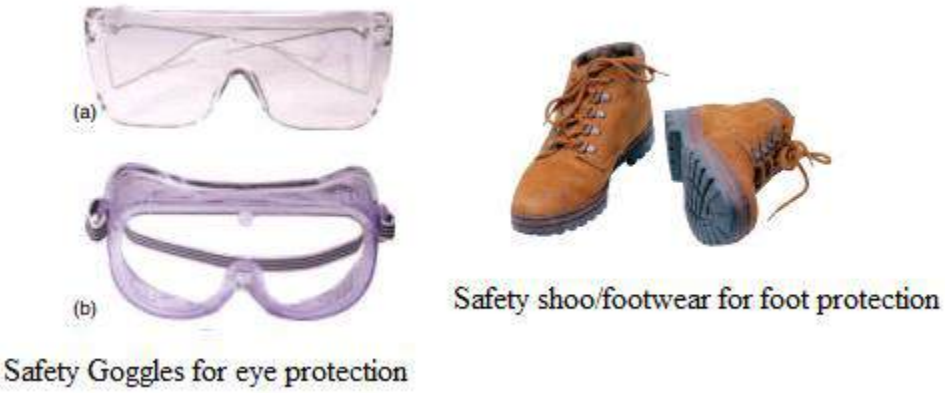
1.4.2 Safety signs

There are four groups of safety signs:

Figure 1.3 A groups of safety signs

1.4.3 General introduction to 'PPE'

The equipment is defined as all equipment that is designed to be worn or held to protect against risks to health and/or safety. 'PPE' includes most types of protective clothing and equipment, such as eye, hand, foot, and head protection. All PPE clothing and equipment must carry the CE marking. Responsible body has a duty to assess any work-related risks that you may face, and where possible, minimize the risks at work although some work tasks that you will be asked to complete will carry a certain degree of risk. In these situations, PPE will be used as a last resort to keep you as safe as possible. The following are some of the PPE equipment's:



Safety glove for hand protection

Safety helmet for head protection

Heading phone for ear protection

Figure 1.4 PPE

1.5 Planning and Sequencing Tasks

Planning a basic management function involving formulation of one or more detailed plans to achieve optimum balance of needs or demands with the available resources. The planning process in pipe system planning and sequencing Tasks**:-**

(1) Seat out procedure
(2) Prepared the required materials
(3) Formulates strategies to achieve the plan
(4) Arranges or creates the means required and
(5) Implements, directs, and monitors all steps in their proper sequence.
(6) Install pipe system for building
(7) Fixe and maintain deferent problems

1.6 Selecting tools and equipment, including personal safety equipment

For the purposes of planning, laying the pipe system, and maintaining, you will need a variety of tools and equipment to enable you to measure and draw up your plans.

This will include:

- Measuring instruments such as, tapes, spirit levels, and laser measuring devices
- Drawing materials such as, pencils, fine line pens, large paper with grid lines
- Digital cameras to take photographs of the damage fixtures and connections

- A calculator to make calculations on site if required.
- Hand and power tools

1.6.1 Provide equipment and materials.

Dedicated equipment and materials will be used for pipe and fixture installation and maintenance. Each Section shall be provided with the necessary equipment to implement an effective combination of both installation and maintenance. This equipment shall include, but not be limited to:

Plumbing tools: Introduction, as a plumber, you will be required to understand tools for:

Measure, mark out, cut, fabricate, make joint, and fix a range of materials.

1.6.2 Jointing tools

There are three considerations here for jointing by soldering, compression fittings, and jointing using the latest push fit methods. There is also jointing of LCS using threaded fittings. Let us see what they look like in Figure 1.5.

(a) Adjustable Basin Wrench, (b) Adjustable Wrench, (c) Basin Wrench, (d) Adjustable spanner (e) One Hand Speed Wrench, (f) 250 mm Water pump Pliers, (g) Blow Lamp-Propane Torch, (h) Combination Pliers and (i) Curved Jaw Locking Pliers


(a)
(b)
(c)
(d)
(e)
(f)
(g)
(h)
(i)
(j)

And also, (A)-Drill-powered auger, (B)-Blow bag, (C)-Spud wrench, (D)-Pipe wrench, (E)-Force cup, (F)-Tubing cutters, and (G) Plastic tubing cutter

Figure 1.5 Plumbing hand tools

Power tools

Figure 1.6 Plumbing power tools

1.7 Preparing Work area

Preparing installation and maintenance area shall be kept to a minimum, and limited to the footprint of the site and any safety buffer zone. Installation and maintenance activities shall be kept strictly to the footprint of the plumbing.

Where possible, identifying the exact damage area ensures their translocation to a safe and suitable area prior to construction. The technical shall be briefed about the location and importance of damage of pipe and fixtures. Based on the damage the material type and method of maintaining shall be optimized in order to minimize expense.

1.7.1 Identify and manage fixtures and building pipe system

a. Attempt to locate existing fixtures and pipe systems;

b. Ask owners how it damage to identify the exact failure

c. Develop procedures for constructing through pipe system, maintaining fixtures during construction, and repairing pipe systems.

d. Engage qualified, to conduct or monitor repairs to pipe systems and fixture in construction.

e. Maintain water flow in building, unless shutoff is coordinated with affected parties.

Self-Check 1	**Written Test**

Instructions*:* Answer all the questions listed below. Each questions contain (5points)

1. What is planning in Installing and maintenance?
2. Write the process of planning to installing and Adjusting drainage system?
3. Write at least 4 plumbing hand tools to do installation system?
4. List at least 3 PPE?
5. Write at least 3 plumbing power tools to do installation system?

OPERATION SHEET-1

OPERATION TITLE:-Plan and preparing work

PURPOSE:-

To apply quality work and health care

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-

- ✓ Safe working area environment
- ✓ Availability of proper tools and equipment's

EQUIPMENT TOOLS AND MATERIALS : -

Safety, hand and power tools

PROCEDURE,

1. Secure workshop manuals, specifications, and tools and equipment;
2. Prepare the workstations for installation works;
3. Select appropriate methods based available materials
4. Select appropriate safety tools
5. Observe the proper application of Occupational Health and Safety requirements.
6. Follow the instruction and done the work

PRECAUTIONS:-

- ✓ Wear appropriate clothes, shoe, glove, goggle...
- ✓ Ensure the work shop safe
- ✓ Ensure the working area is bright / good visibility
- ✓ Able to make workstation comfortable

QUALITY CRITERIA:

Assured the performance of all the activities according to the given guide.

Information Sheet-2	Water Supply System in Building

2. WATER SUPPLY SYSTEM IN BUILDING

2.1 Introduction

A typical home plumbing system includes three basic parts: a water supply system, a fixture and appliance set, and a drain system. These three parts can be seen clearly in the Figure 2.1. Fresh water enters a home through a main supply line (1). The fresh is provided by either a municipal water company or a private underground well. This fresh water passes through a meter (2) that registers the amount of water used. Immediately after the main supply enters the house, a branch line splits off (3) and is joined to a water heater (4). From the water heater, a hot water line runs parallel to the cold water line to bring the water supply to fixtures and appliances throughout the house. Fixtures include sinks, bathtubs, showers, water closet, lavatory, and bidet. Appliances include water heaters, dishwashers, clothes washers, and water softeners. Toilets and exterior sill cocks are examples of fixtures that require only a cold water line. The water supply to fixtures and appliances is controlled with faucets and valves. Faucets and valves have moving parts and seals that eventually may wear out or break, but they are easily repaired or replaced. Waste water then enters the drain system flow through a drain trap (5). Every fixture must have a drain trap. The drain system works entirely by gravity, allowing waste water to flow downhill through a series of large diameter pipes. These drain pipes are attached to a system of vent pipes (6). The vent pipes bring air into the drain system to prevent suction or pressure that might allow the trap to lose its water seal. Vent pipes usually exit the house at a roof vent (7). All waste water eventually reaches a drainage stack or a building drain (8). And 9 is the total waste drainage system.

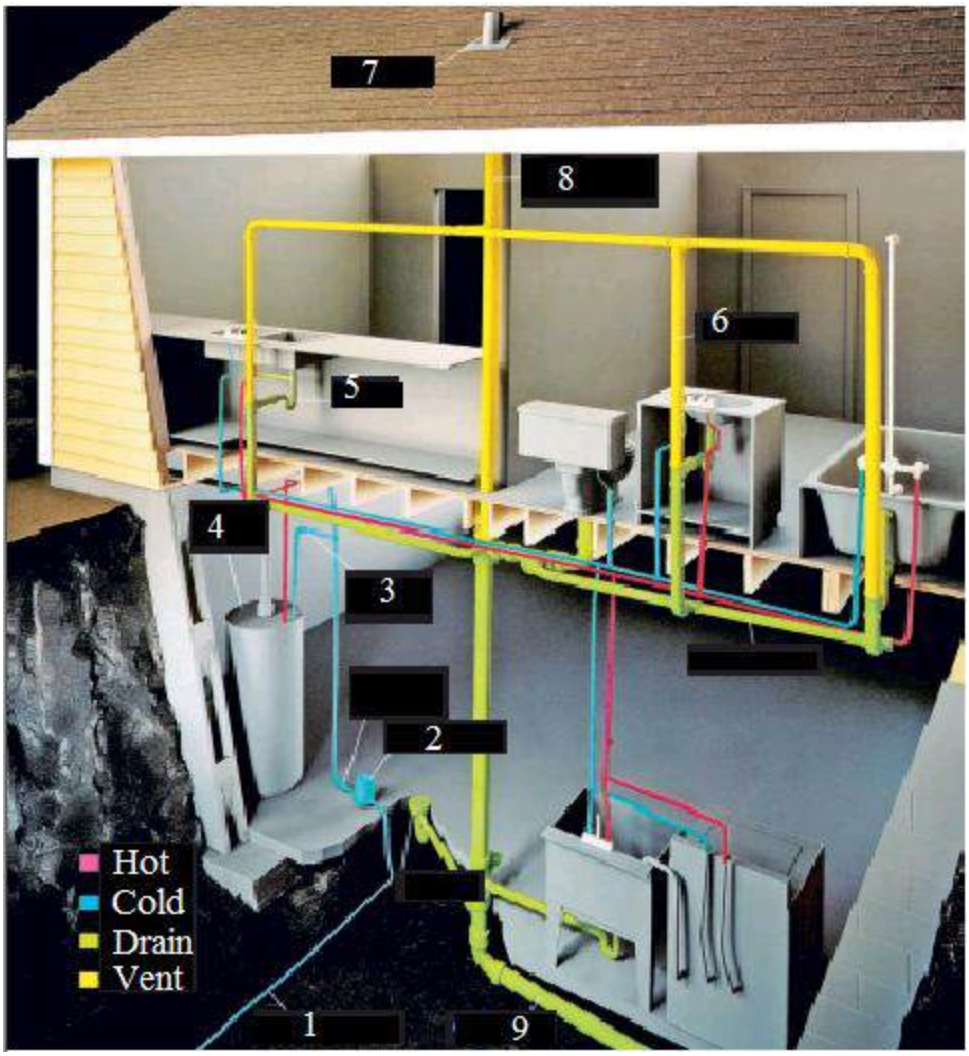


Figure 2.1 Building water System

2.2 Water system types

There are two types of cold water system:

- Direct
- Indirect

2.2.1 Direct system

With a direct system, the cold water is supplied directly from the mains supply to all the draw-off points within the building, i.e. washbasin, bath, kitchen sink, WC, etc, as shown in Figure 2.2.

The installation of a direct water system offers a supply of water at mains (high) pressure to all draw-off points within the building. These installations are permitted by Water Suppliers in regions where the mains supply can provide adequate quantities of water at sufficient pressure.

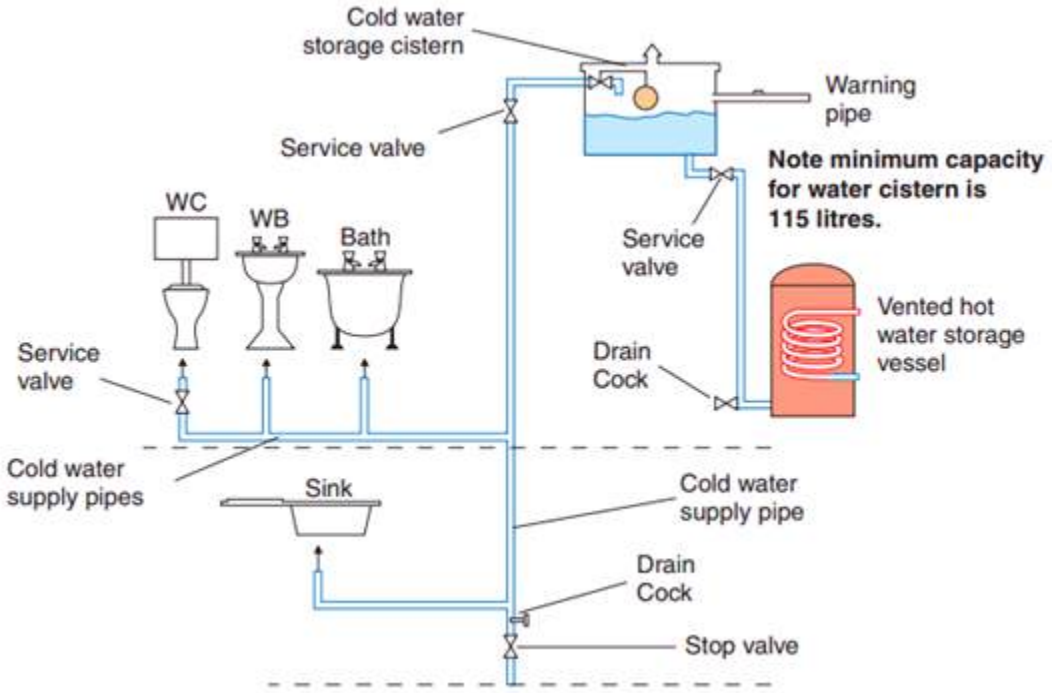


Figure 2.2 Direct building water supply systems

2.2.2 Indirect system

The installation of an indirect water system offers a supply of low pressure water from the storage cistern to the designated draw-off points within the dwelling or building. Provision should be made for one outlet to be directly fed from the mains, supplying wholesome water for drinking, cooking food, and washing purposes (refer to Figure 2.3).

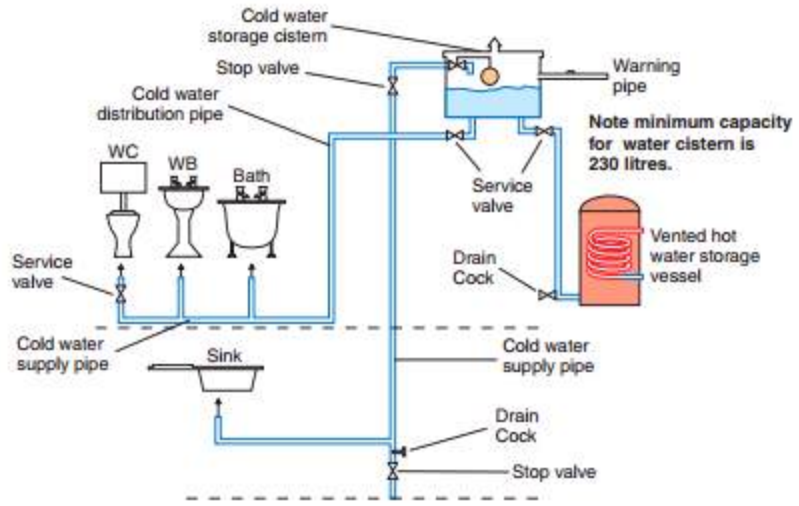


Figure 2.3 Indirect building water supply systems

2.2.3 Ventilated stack system

Ventilated installing system is in the majority of housing dwelling situations, Figure 2.4 shows a primary ventilated stack. There are limitations to the minimum pipe sizes, maximum lengths of the branch connections and their gradients. In the system there is some flexibility; however, the size of the branch pipes should always be at least the same diameter as the trap.

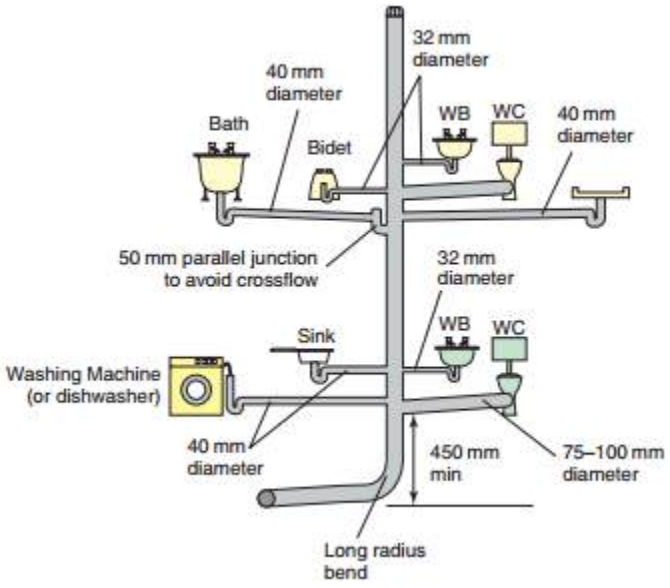


Figure 2.4 Building ventilated system

2.3 Plumbing Materials

There are different types of pipes that used in plumbing installations. Depending on where to be used, either in supplying water to different parts of the building or to remove and discharge human waste and other substances out of building, are important to the choice of the kind of pipe to be installed or used will depend upon the following considerations:

1. Quality and durability
2. Resistance to external and internal contact with foreign matters.
3. Resistance to acid waste and other chemical elements that will pass into it.
4. Cost of material and labor.

Pipes

Water supply pipes are fundamental components of water supply and drainage system, which keep buildings and homes functioning, and factories safe.

Table 2.1 Types of plumbing pipes

PVC - Used as a cold water supply pipe in many countries around the world because of the price but lacks long term durability.	
CPVC - Used as a hot/cold water supply pipe in many countries around the world because of the price but lacks long term durability.	
PEX - Is cross-linked polyethylene tubing and has become the standard in new home construction. PEX comes in a variety of colors and is used for plumbing and heating purposes.	

Galvanized pipe - May still be found in many homes but is seldom used anymore because of water discoloration, cost and difficult repairs.

Fittings:- A fittings are used in pipe and plumbing systems to connect straight pipe or tubing sections, to adapt to different sizes or shapes, and for different purposes, such as regulating or measuring water flow. Plumbing is generally used to describe conveyance of water, or liquid waste in ordinary domestic or commercial environments. The pipes in plumbing used to describe high-performance (high pressure, high flow, high temperature, hazardous materials) conveyance of water flow in specialized applications. The tubing is used for lighter-weight piping, the types that are flexible enough to be supplied in coiled form.

Figure 2.5 Pipe and steel fittings

Elbow: - It is fitting type installed between two lengths of pipe or tubing to allow a change of direction, usually a 90° or 45° angle, and 22.5° elbows are also made.


Figure 2.6 Elbow fitting connects pipes

Union:- A union is designed to allow quick and convenient disconnection of pipes for maintenance or fixture replacement.

Figure 2.7 Union fittings

Reducer:- A reducer allows for a change in pipe size to meet hydraulic flow requirements of the system, or to adapt to existing piping of a different size

Figure 2.8 Reducer fittings

Tee:- Tee is a type of pipe fitting which is T-shaped having two outlets, at 90° to the connection to the main line. A tee is the most common fitting, which is available with all female thread sockets, all solvent weld sockets, or with opposed solvent weld sockets and side outlet with female threads. It is used to either split or combine a water flow.


Figure 2.9 Tee fitting

Cross:- Cross fittings or four way fittings, this fitting has one inlet and three outlets, or vice versa. They often have solvent welded socket ends or female threaded ends.

Figure 2.10 Cross fittings

Nipple:- A short stub of pipe, usually with threaded in steel, brass, chlorinated polyvinyl chloride (CPVC) or copper. A nipple is expresses as being a short stub of pipe which has external male pipe threads at each end, for connecting two other fittings.

Figure 2.11 Nipple fitting

Valves:- Valves are equipment designed to stop or regulate flow of water in its path. Various types of valves are available depending upon the type of construction as follows:

1. Gate valve - used for isolation only
2. Plug valve - used for isolation only

3.Globe valve - used for throttling

4. Butterfly valve - used for isolation as well as throttling
5. Check valve - used for preventing reverse flow (non-return)

6.Diaphragm valve - used for isolation as well as throttling

7. Ball valve - used for isolation only

Figure 2.12 Gate valve

2.4 Protection of pipes and fittings

To protect the risk pipe like freezing, it must be protected using the approved pipe insulation material. Most people think that pipe insulation prevents the freezing of the water contained within the pipe by keeping out the cold; while, in fact, the insulation is designed to retain the heat energy in the water, thereby reducing the risk of freezing. The efficiency of pipe insulation is dependent on the following factors:

- Its thickness
- Its thermal conductivity

So basically the thickness of insulation required will be dependent on:

- The pipe diameter
- The insulation type and its thermal conductivity
- The reason for the insulation, e.g. frost protection, heat loss/gain or to prevent condensation on the pipe
- Location of pipework, indoors/outdoors, in heated or unheated areas.

2.5 Pipe System Installation and Measurement

Pipe system joint methods

For domestic installations, there are two main jointing methods:

- Threaded joints
- Compression joints

2.5.1 Types of Measurements

From the several methods of pipe lengths measurement, the most commonly used are face-to-face, end-to-end and the center-to-center methods, as shown in Figure 2.13.

Face-to-Face: A face-to-face measure is the distance between the faces of each fitting. To determine the pipe length, add the pipe distance for each fitting to the face-to-face measurement.

Center-to-Center: A center-to-center measure is used when pipe fittings are on each end. To determine the pipe length, subtract the sum of both fitting dimensions and then add the sum of both pipe engagements.

End-to-End: End-to-end measure is the full length of pipe, including both threads.

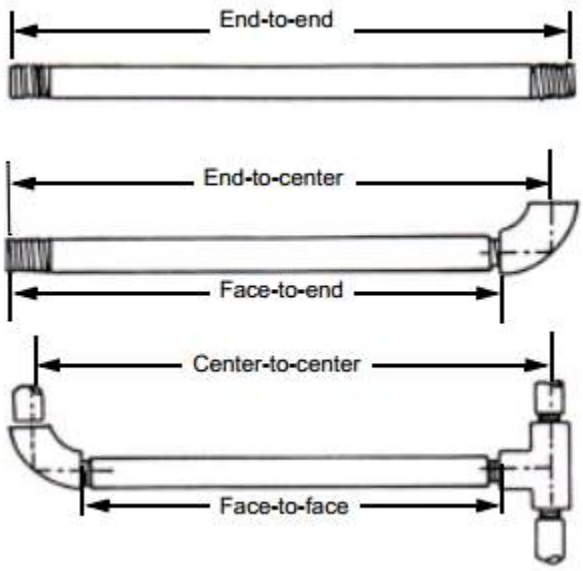


Figure 2.13 Dimension measurement methods

Offset: An offset measurement is used to install a pipeline run around an obstacle (in the Figure 2.14 the distance A or B). The following steps explain how to run an offset using steel-threaded pipe; 45-degree elbows with a fitting and threaded-pipe.

Example: explain how to run an offset using 3-inch steel-threaded pipe; 45-degree elbows with a fitting dimension of $4\frac{5}{8}$ inches; and a 1-inch threaded-pipe engagement:

Step 1. Determine the vertical distance "A" from center to center of the pipe. In this example, the distance is 40 inches.

Step 2. Refer to offset Table 2.4 for the 45-degree offset constant, which is 1.4142.

Step 3. Multiply 1.4142 inches by 40.

$1.4142 * 40 = 56.57 = 56\,{}^{9}/_{16}\ inch\ of\ pipe$

Step 4. Since two elbows are needed, subtract the sum of both elbow-fitting dimensions from $56\,^{9}/_{16}$ inches. A 3-inch, 45-degree elbow-fitting dimension is $4\,^{5}/_{8}$inches.

$4\,^{5}/_{8} + 4\,^{5}/_{8} = 8\,^{10}/_{8} = 9\,^{2}/_{8} = 9\,^{1}/_{4}\,(or 9\,^{4}/_{16})$ then;

$56\,^{9}/_{16} - 9\,^{4}/_{16} = 47\,^{5}/_{16}$

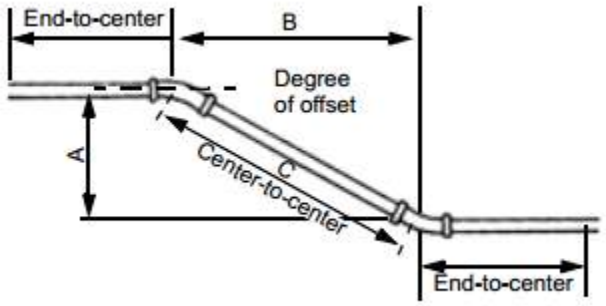


Figure 2.14 Offset and dimension layout

Table 2.3 Offset lengths

Degree of Offset	When A=1, B=	When B=1, A=	When A=1, C=
60	0.5773	1.7320	1.1547
45	1.0000	1.0000	1.4142
30	1.7320	0.5773	2.0000
22 1/2	2.4140	0.4142	2.6131
11 1/4	5.0270	0.1989	5.1258
5 3/8	10.1680	0.0983	10.2170

2.6 Cast Iron Thread and Cutting

Cast-iron pipe can be cut by scoring with a hammer and cold chisel or by cutting with a soil-pipe cutter (as showed Figure 2.16).

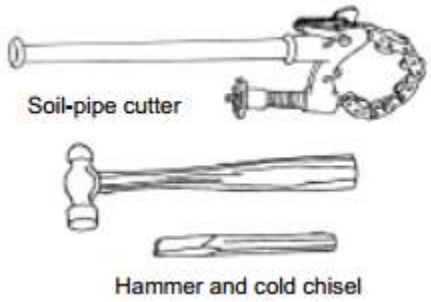


Figure 2.15 Cast-Iron Pipe Cutting Tools

Use the following steps to cut the Cast Iron:

Step 1. Make a chalk or crayon mark completely around the pipe where it will be cut.

Step 2. Cut the pipe with a soil-pipe cutter or by using a hammer and cold chisel.

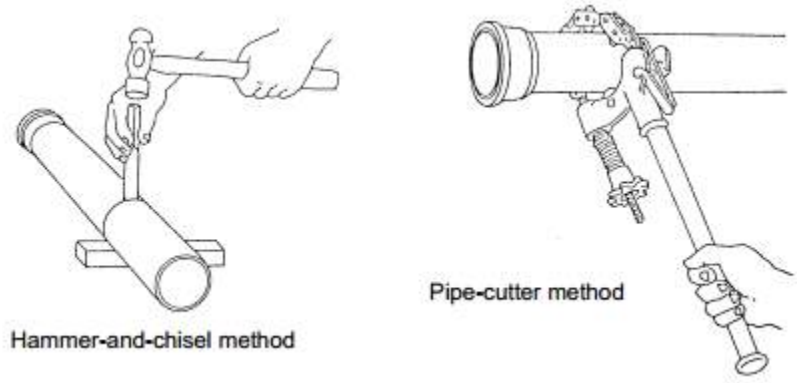


Figure 2.16 Cutting method of cast Iron

2.6.1 Galvanized-Steel/Iron Pipe and Fittings Use

Galvanized steel pipe is often found in older homes, where it is used for water supply and small drain lines. It can be identified by the zinc coated that gives it a silver color with threaded fitting used to connect pipes. Galvanized steel pipes and fittings will rust with age and eventually must be replaced. Low water pressure may be cause rust or other formation insides of galvanized pipes. Blockage usually occurs in elbow fittings. Do not try to clean the insides of galvanized steel pipes, instead, remove and replace them as soon as possible.

2.6.2 Types and Sizes

The pipe consist three strength classifications: (1) standard, (2) extra strong, and (3) double extra strong. The Standards of pipe describe pipe strengths. Pipe diameter sizes (nominal pipe sizes) are $^{1}/_{8}$ inch to 12 inches, also referred as iron-pipe size. The pipe comes in 21-foot lengths, threaded or unthreaded (as shown in the Figure 2.17).

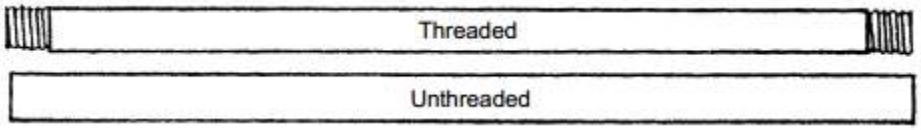


Figure 2.17 Threaded and unthreaded Iron pipe

A-Street 90, B-90, C-Reducing coupling, D-Coupling, E-45, F-Street 45, G-T, H-Reducing T, I-Reducing bushing, J-Plug, K-Cap, L-Cross and M-Reducing T;

Figure 2.18 The most commonly used galvanized fittings

2.6.3 Galvanized Pipe Cutting and Installation

Threading, Cutting, and Reaming

A steel pipe is cut and reamed using a vise, pipe cutter, and reamer

Pipe threading machines, like the one shown here (or even smaller portable versions) provide a quicker and easier method of forming threads for pipes. The machine is an 'all in one' combined pipe cutter, de-burring reamer, also comprising stock head and dies as shown in Figure 2.19,

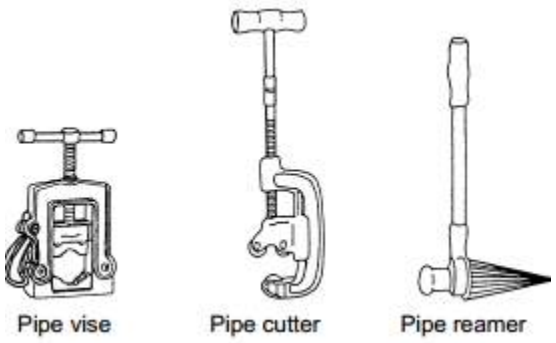


Figure 2.19 Steel-Pipe Tools

The steps to form cut cast iron

Step 1. Determine the length of pipe and mark the spot for cut.

Step 2. Lock the pipe tightly in the vise with the cutting mark about 8 inches from the vise.

Step 3. Open the jaws of the cutter, using the single-wheel cutter, by turning the handle counter clockwise.

Step 4. Place the cutter around the pipe with the cutting wheel exactly on the mark. The rollers will ensure a straight cut (Figure 2.20 A). If using a three-wheel cutter, place the cutting wheel of the movable jaw on the mark; ensure that all three wheels are at right angles to the centerline of the pipe.

Step 5. Close the vise jaws lightly against the pipe by turning the handle clockwise.

Step 6. Give the handle a quarter turn clockwise when the cutting wheel and roller shave made contact with the pipe.

Step 7. Apply cutting oil and rotate the cutter completely around the pipe, making a quarter turn on the handle for each complete revolution around the pipe. Continue the action until the pipe will cut.

Step 8. Push the reamer into the pipe. Turn the reamer clockwise in short, even strokes, while keeping steady pressure against the pipe (see Figure 2.20 B) until the inside burrs are removed. Step 9. Remove the outside burrs with a file if using a three-wheel cutter.

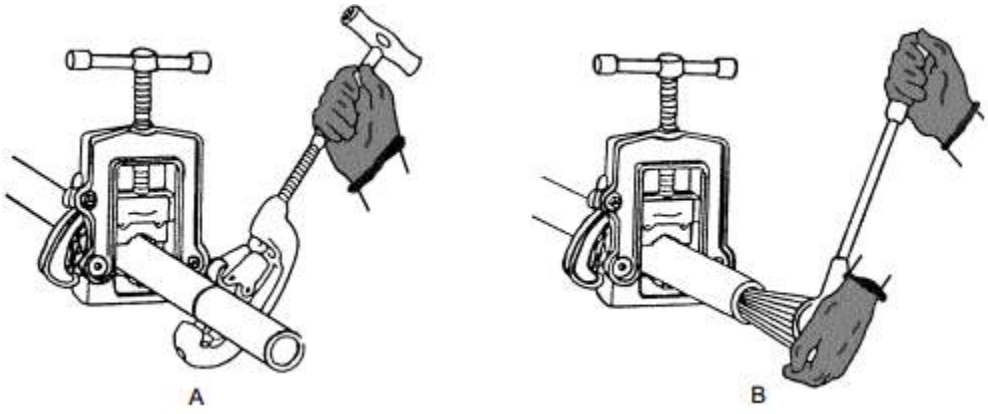


Figure 2.20 Cutting steps of Iron pipe

2.6.4 Use of pipe threading machine

There are several types of thread machines, such as automotive that produce fine and course threads and plumbing and pipefitting threads identified. Pipe threads are cut at a taper. There are different types of pipe-threading sets are in use. A common set contains a ratchet, nonadjustable stock with solid dies, and individual guides (Figure 2.21). A die and guide must be the same size to fit the pipe size being threaded.

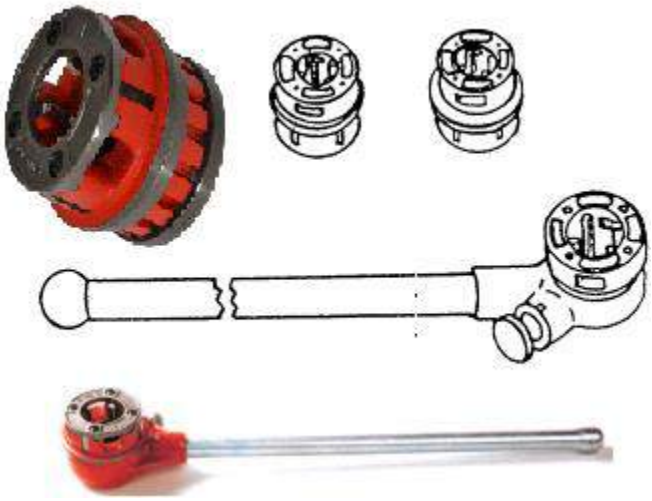


Figure 2.21 Thread machine

When using a threading set, refer to the manufacturers or the accompanying instructions with the following steps:

Step 1. Lock the pipe securely in the vise with enough pipe projecting for threading.

Step 2. Slide the diestock over the end of the pipe with the guide on the inside. Push the die against the pipe with one hand (as shown in Figure 2.22).

Step 3. Make three or four short, slow, clockwise strokes until the die is firmly started on the pipe. Apply cutting oil on the die.

Step 4. Give the stock a complete clockwise turn, and then turn it counterclockwise a quarter turn. This will clear cut metal from the die and burrs from the new threads. Continue to apply oil.

Step 5. Continue Step 4 until $1/2\ or\ 1/4$ inch extends from the diestock. Continued threading will cause the thread taper to be lost.

Step 6. Carefully turn the diestock counterclockwise until the die is free of the cut threads.

Step 7. Use a heavy rag to wipe away excess oil and a wire brush to remove any chips. The pipe is now ready to be joined.

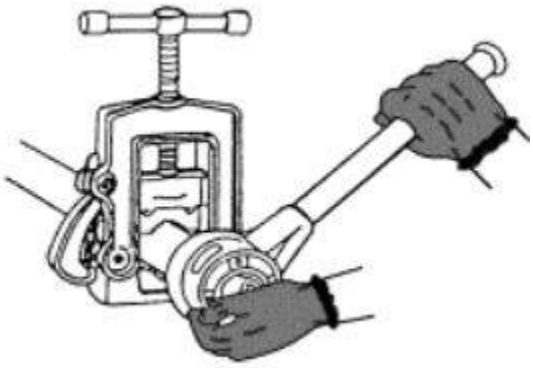


Figure 2.22 Steps of making thread

Table 2.5 Information to determine thread length

Normal Pipe Size (in Inches)	Threads Per Inch	Approximate Length of Thread (in Inches)	Approximate Numbers of Threads to be Cut	Approximate Total Thread Makeup Engagement (in Inches)
1/4	18	5/8	11	3/8
3/8	18	5/8	11	3/8
1/2	14	3/4	10	7/16
3/4	14	3/4	10	1/2
1	11 1/2	7/8	10	9/16
1 1/4	11 1/2	1	11	9/16
1 1/2	11 1/2	1	11	9/16
2	11 1/2	1	11	5/8
2 1/2	8	1 1/2	12	7/8
3	8	1 1/2	12	1
3 1/2	8	1 5/8	13	11/16
4	8	1 5/8	13	11/16
5	8	1 3/4	14	13/16
6	8	1 3/4	14	13/16

2.6.5 Joining pipes and fittings

Fittings are normally screwed to the pipe after it is threaded, while the pipe is still in the vise to ensure good fitting. The assembled pipe and fittings should then be screwed into the proper place in the installation. Steps in joining pipes and fittings:

Step 1. Check the fitting threads for cleanliness and damage. If necessary, clean with a wire brush or replace.

Step 2. Repeat Step 1 for the pipe threads.

Step 3. Apply pipe-joint compound or Teflon tape to the pipe threads only (Figure 2.23).

Step 4. Screw the fitting on, hand tight (Figure 2.23).

Step 5. Tighten the fitting using two pipe wrenches, one on the fitting (backup wrench) and the other on the pipe (Figure 2.23). The backup wrench keeps the fitting from turning.

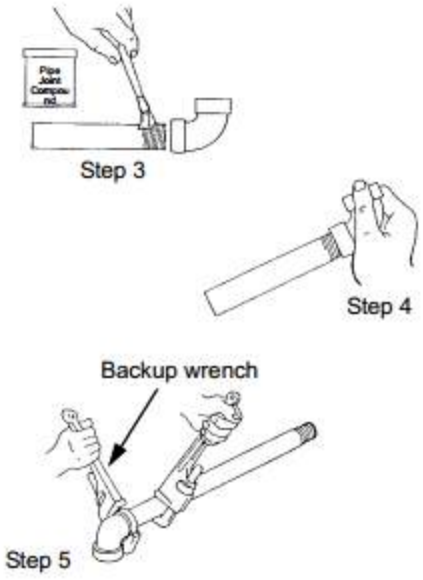
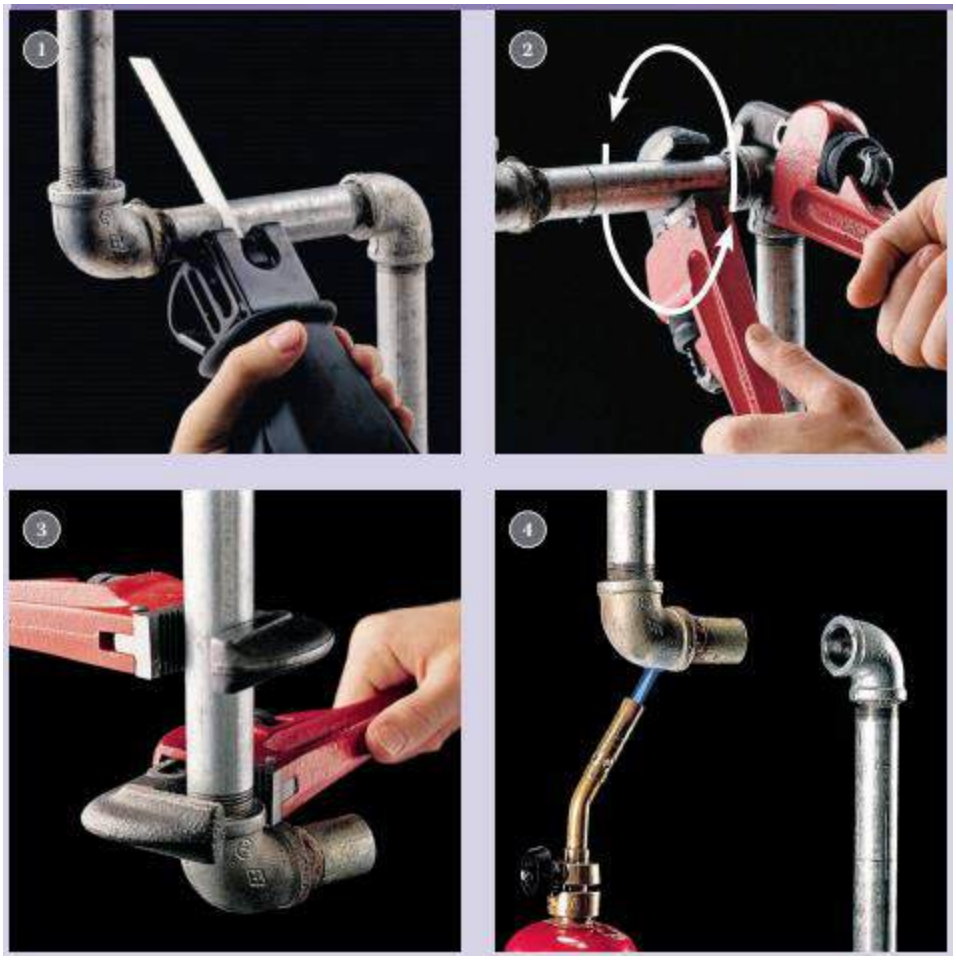


Figure 2.23 Joining threaded pipe

2.6.6 Removing and replacing galvanized steel pipe

1. Cut through galvanized steel pipe with a reciprocating saw and a metal cutting blade or with a hacksaw.
2. Hold the fitting with one pipe wrench, and use another wrench to remove the old pipe. The jaws of the wrenches should face opposite directions. Always move the wrench handle toward the jaw opening.
3. Remove any corroded fittings using two pipe wrenches. With the jaws facing in opposite directions, use one wrench to turn fitting and the other to hold the pipe. Clean the pipe threads with a wire brush.
4. Heat stubborn fittings with a torch to make them easier to remove. Apply the flame for 5 to 10 seconds.



5. Replace a section of galvanized steel pipe with a union fitting and two threaded pipes (nipples). When assembled, the union and nipples must equal the length of the pipe that is being replaced.
6. Apply a bead of pipe joint compound or pipe tape around the threaded ends of all pipes and nipples. Spread the compound evenly over the threads with your fingertip.
7. Screw new fittings onto pipe threads. Tighten fittings with two pipe wrenches, leaving them about one‑eighth turn out of alignment to allow assembly of the union.

8. Screw the first nipple into the fitting, and tighten with a pipe wrench.
9. Slide a ring nut onto the installed nipple, then screw the hub bed union nut onto the nipple and tighten with a pipe wrench.
10. Screw the second nipple onto the other fitting. Tighten with a pipe wrench.
11. Screw the threaded union nut onto the second nipple. Tighten with a pipe wrench. Turn pipes into alignment, so that the lip of the hub-bed union nut fits inside the threaded union nut.
12. Complete the connection by screwing the ring nut onto the threaded union nut. Tighten the ring nut with pipe wrenches

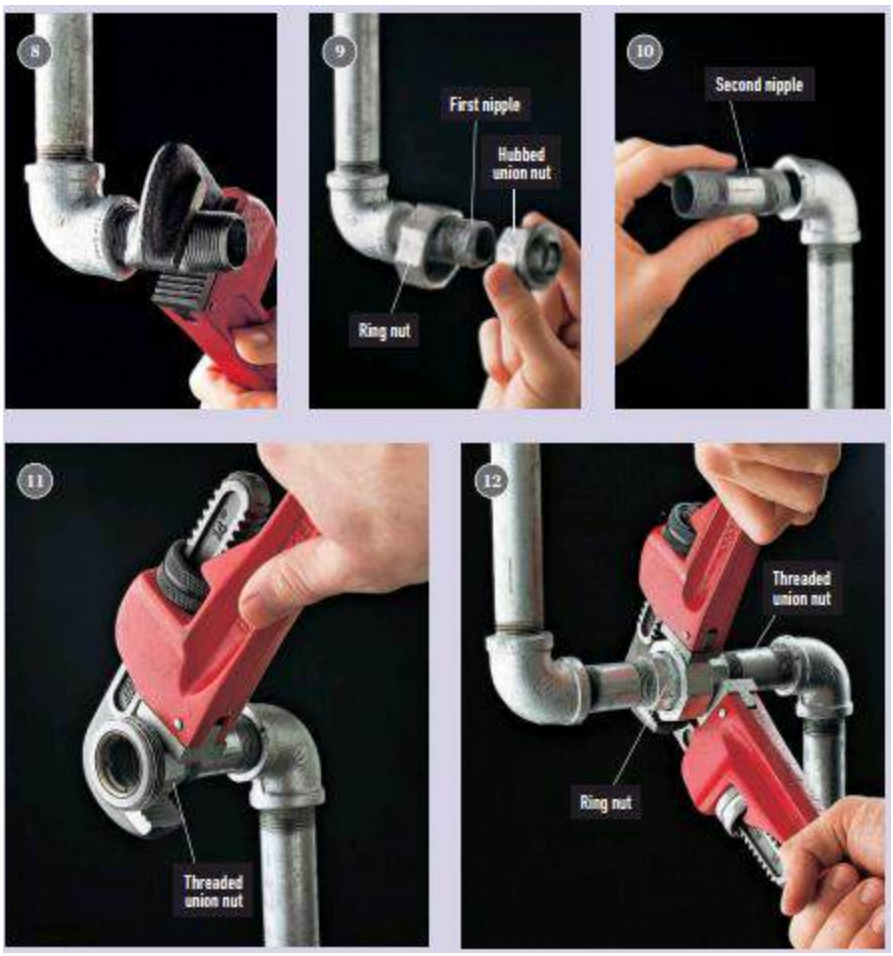


Figure 2.24 Replacing, maintaining, and joining old pipe

2.7 Copper Tubing and Fittings

Copper tubing is lightweight, easily joined, and corrosion-resistant. It can be rigid or flexible, and it is classified by its wall thickness. Copper tubing is used for hot and cold water supply systems, drainage system, and venting.

2.7.1 Types and Sizes

Types and sizes of copper tubing include the

1. K: K is a thick-walled, rigid or flexible copper tubing available in 20-foot lengths or 100-foot coils. Diameter sizes range from $1/4$ inch to 12 inches.
2. L: L is a medium-walled, rigid or flexible copper tubing available in 20-foot lengths or 100-foot coils. Diameter sizes range from $1/4$ inch to 12 inches.
3. M: M is a thin-walled, rigid copper tubing available in 20-foot lengths. Diameter sizes range from $1/4$ inch to 12 inches.
4. Drain waste vent (DWV). DWV is available in 20-foot lengths. Diameter sizes range from $1\frac{1}{4}$ to 8 inches.

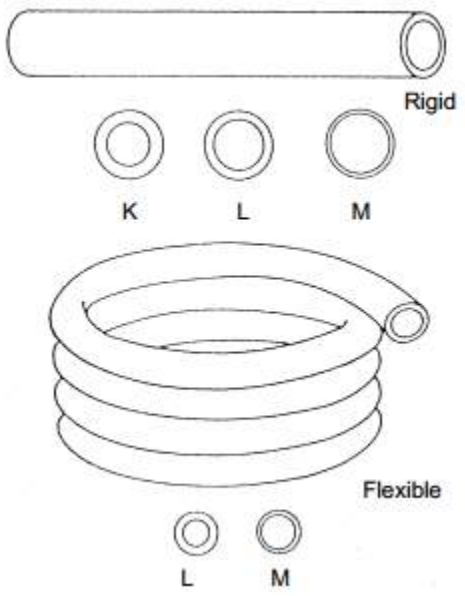


Figure 2.25 Copper pipe types

2.7.2 Copper Fittings

Fittings for copper tubing can be solder, flared, or compression types (Figure 2.26).

Solder: Solder fittings can be used with either rigid or flexible copper tubing. The fitting sizes are similar to galvanized-steel/iron fittings.

Flared: Flared fittings are used with flexible copper tubing that has flared ends. Fitting sizes range from 3/8 inch to 3 inches in diameter.

DWV: DWV fittings are similar to cast-iron fittings of the solder type.

A-Reducing 90, B-Coupling, C-Reducing coupling, D-Elbow or 90, E, H, and L-Reducing T, F-Drop-ear elbow, G-T, 1-45,J-Male adapter, K-Street elbow, M-Street 45, N-Female adapter

Figure 2.26 Most commonly used copper fittings

2.7.3 Cutting and Reaming

Copper tubing can be cut with a tubing cutter or a fine-tooth hacksaw, as shown in Figure 2.27.

Use the following steps to make a cut:

Step 1. Determine the length of tubing required and mark the spot for the cut.

Step 2. Set the cutting wheel on the mark and turn the cutter knob clockwise to get a bite on the tubing.

Step 3. Hold the tubing firmly with one hand and use the other hand to turn the cutter clockwise around the tubing until the tubing is cut. If using a hacksaw, place the tubing in a miter box or a jig made of lumber to make a square cut.

Step 4. Ream the tubing's cut end with the reamer attached to the tubing cutter. If the cutter does not have a reamer, use a fine metal file.

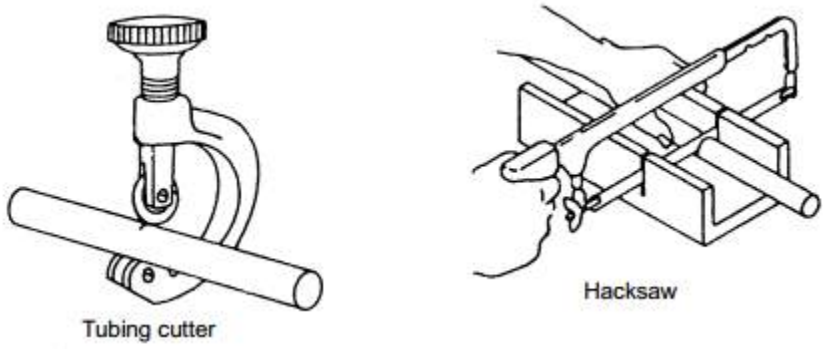


Figure 2.27 Copper pipe cutting method

2.7.4 Methods of jointing copper tube

The joints for copper tube can be classified as:

- Compression joints (Manipulative and Non-manipulative)
- Soldered joints
- Push fit joints

Compression Joints

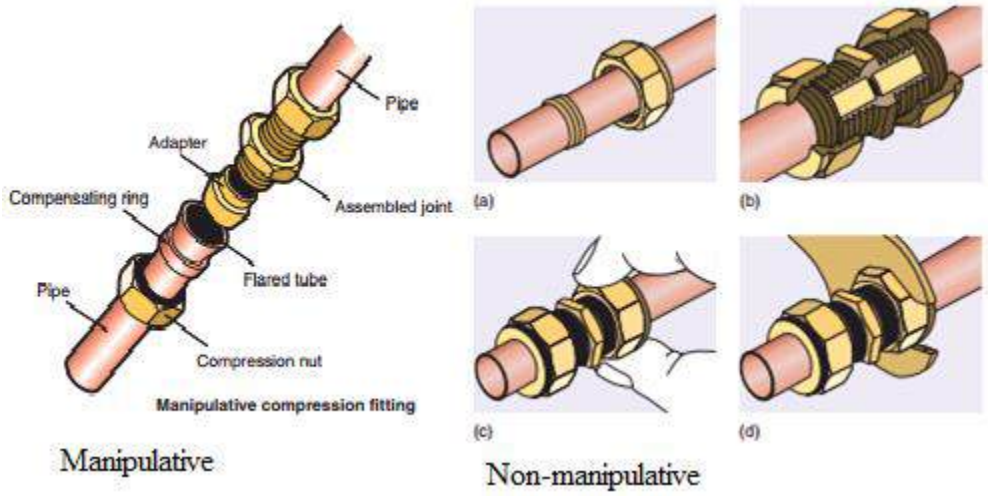


Figure 2.28 Compression Joints in Copper

Soldered Joint

Soldered joints are used to connect rigid copper tubing. The following tools and materials are needed: a heating torch, nonacid solder, soldering flux, and emery cloth or steel wool as shown Figure 2.29.

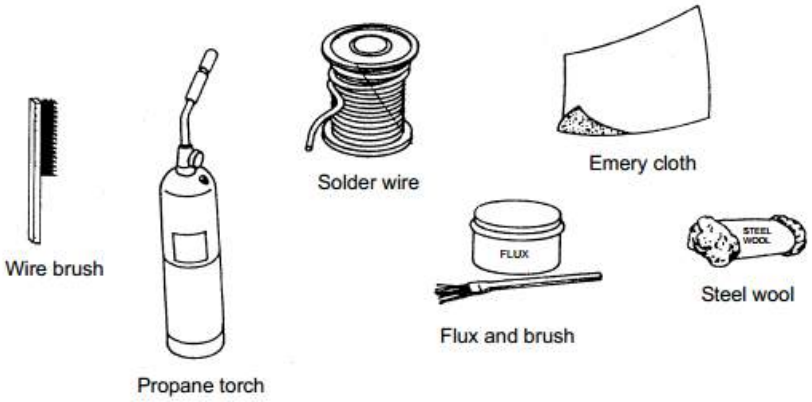


Figure 2.29 Tools for soldering Copper

Soldered capillary joints

Soldered joints can be classified as soft soldered and hard soldered

Soft soldered joints are made using two types of fittings:

- Integral solder ring
- End feed solder

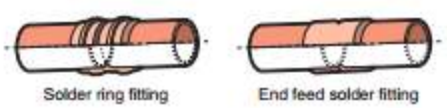


Figure 2.30 Soldered joint types

Use the following steps to make a soldered joint:

Step 1. Inspect the end of the tubing to be sure it is round, free of burrs, and cut square.

Step 2. Clean the end of the tubing and the inside of the fitting to a bright shine with emery cloth or fine steel wool.

Step 3. Apply a thin coat of flux to the shined end of the tubing and fitting (as Figure 2.31).

Step 4. Push the fitting onto the tubing and give it a quarter turn to spread the flux evenly (as Figure 2.31).

Step 5. Heat the connection with a torch, applying the flame on the fitting (as Figure 2.31).

Step 6. When the flux is bubbling, apply the solder to the joint. The solder will flow into and completely around the joint.

Step 7. Clean the joint using a clean rag.

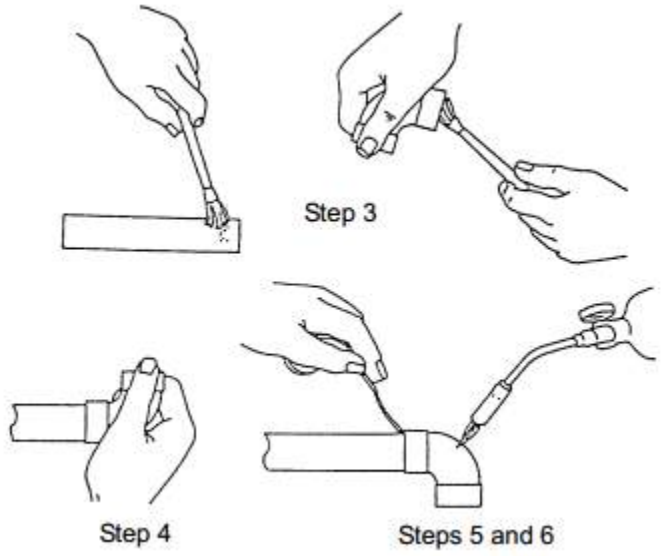


Figure 2.31 Steps of make soldered joint

2.7.5 Cut Rigid and Flexible Copper Pipe

Steps in cute the rigid and flexible copper pipe

1. Place the tubing cutter over the pipe and tighten the handle
2. Turn the tubing cutter one rotation so that the cutting wheel scores a continuous straight line around the pipe
3. Rotate the cutter in the opposite direction, tightening the handle slightly after every two rotations, until the cut is complete
4. Remove sharp metal burrs from the inside edge of the cut pipe

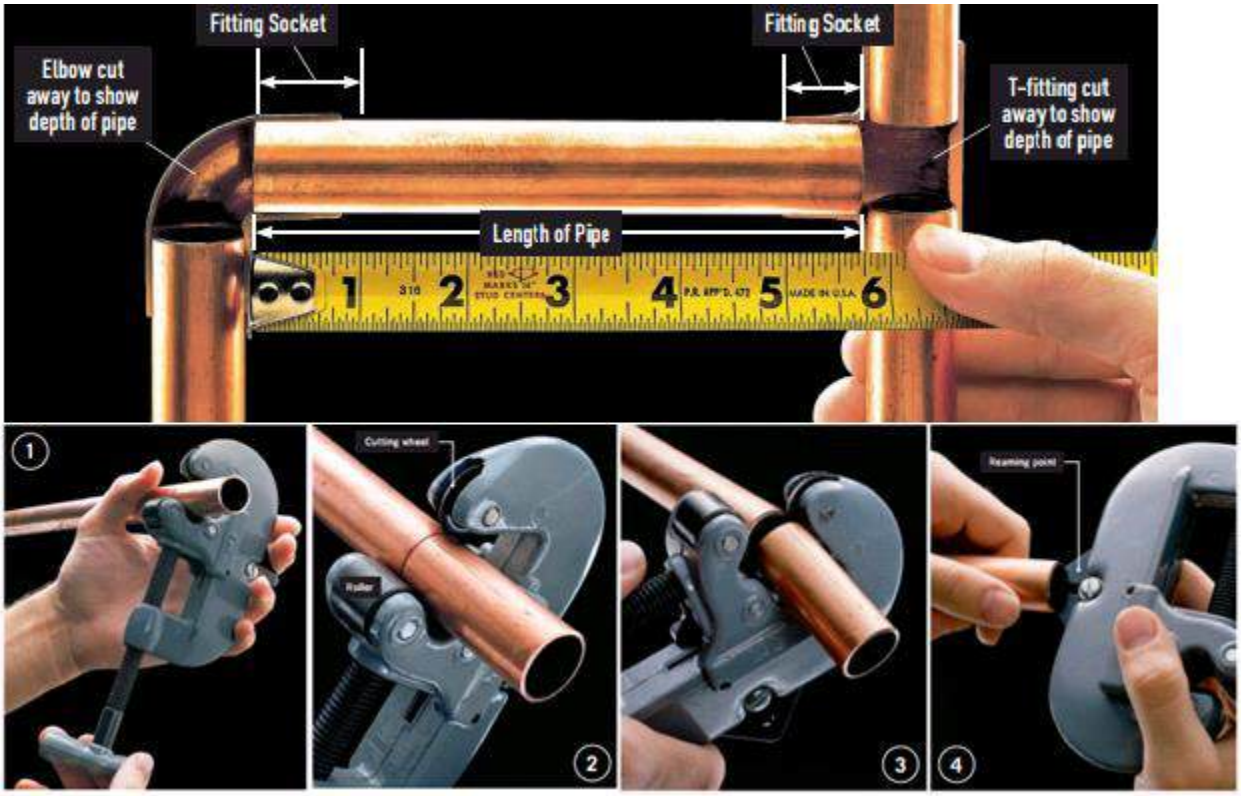


Figure 2.32 Steps of cutting copper pipe

2.7.6 Solder Copper Pipes and Fittings

1. Clean the end of each pipe by sanding with emery cloth
2. Clean the inside of each fitting
3. Apply a thin layer of soldering paste (flux)
4. Apply a thin layer of flux to the inside of the fitting
5. Assemble each joint by inserting the pipe into the fitting

6. Use a clean dry cloth to remove excess flux before soldering the assembled fitting
7. Prepare the wire solder by unwinding
8. Open the gas valve and trigger the spark lighter to ignite the torch
9. Move the torch flame back and forth and around the pipe and the fitting to heat the area
10. Heat the other side of the copper fitting to ensure that heat is distributed evenly
11. When solder melts, remove the torch and quickly push
12. Allow the joint to cool briefly, and then wipe away excess solder with a dry rag

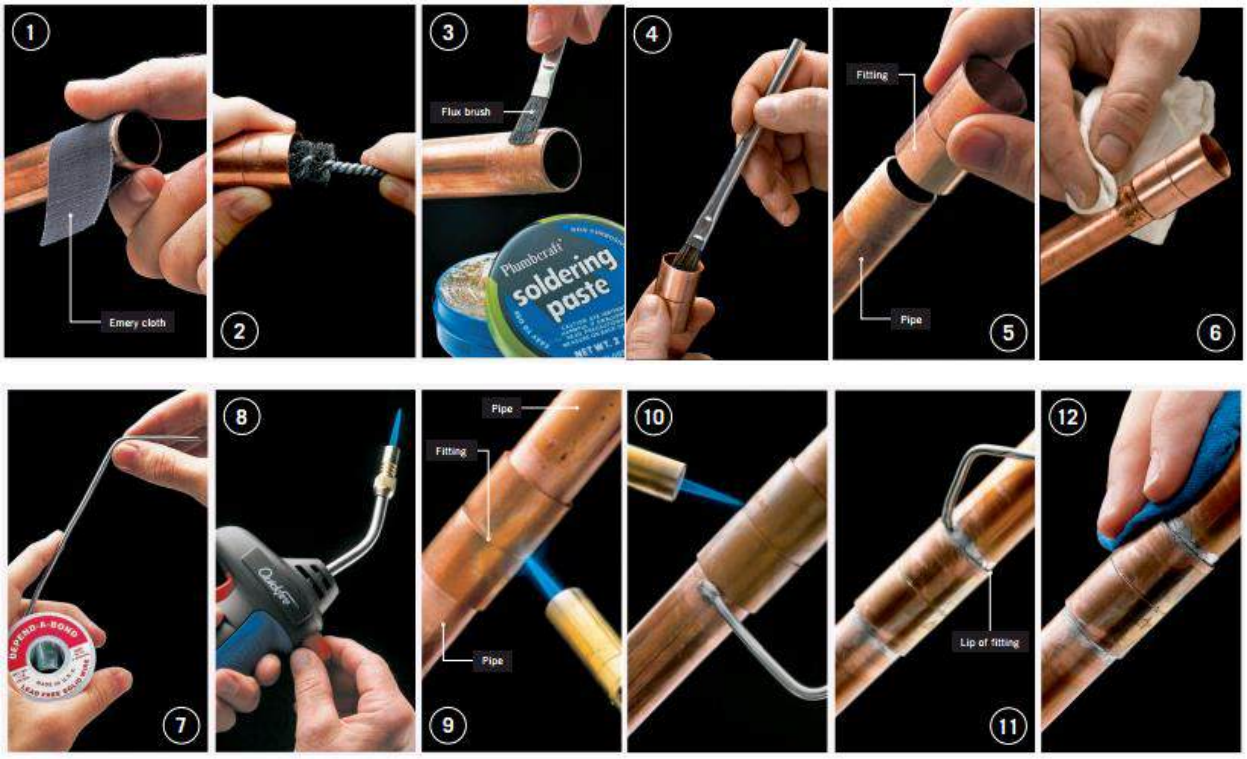


Figure 2.33 Steps of joining soldering Pipe

2.7.7 Dismantling soldered Joint blades

1. Light your torch. Hold the flame tip to the fitting until old pipe solder becomes shiny and begins to melt.
2. Use channel-type pliers to separate the pipes from the fitting.
3. Remove old solder by heating the ends of the pipe with your torch. Use a dry rag to wipe away melted solder quickly. Caution: Pipes will be hot.
4. Use emery cloth to polish the ends of the pipe down to bare metal. Never reuse fittings.

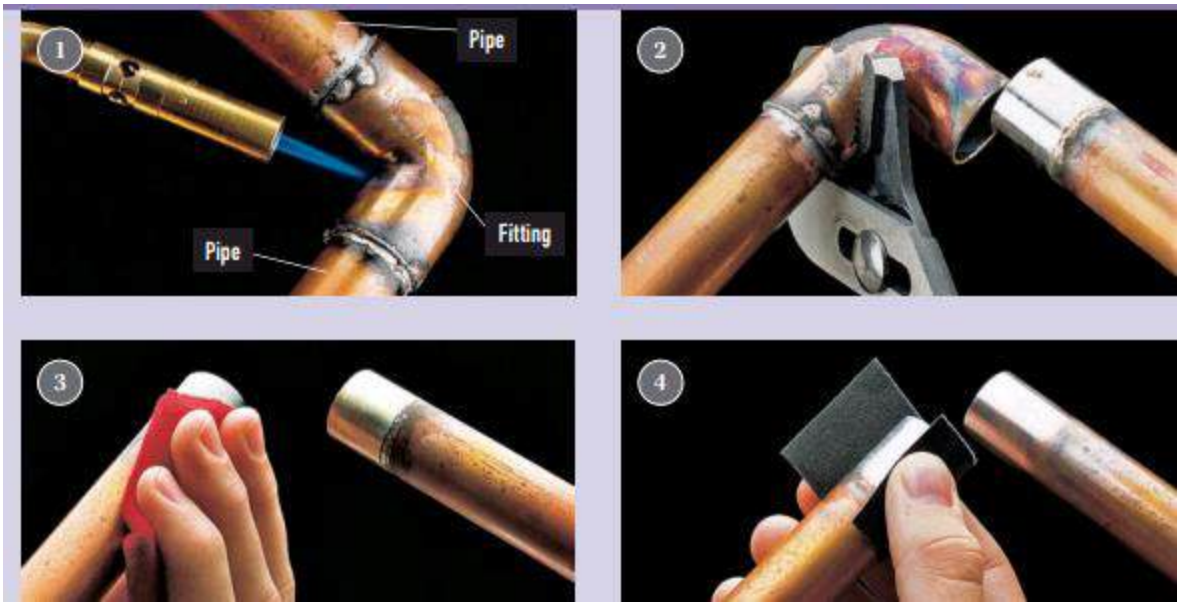


Figure 2.34 Removing of old joining of copper pipe with soldering

2.7.8 Push Fittings

Push fittings make water supply connections easy. They are expensive and difficult to use in large connection. They are also an ideal material for making a quick repair.

Push fit joints

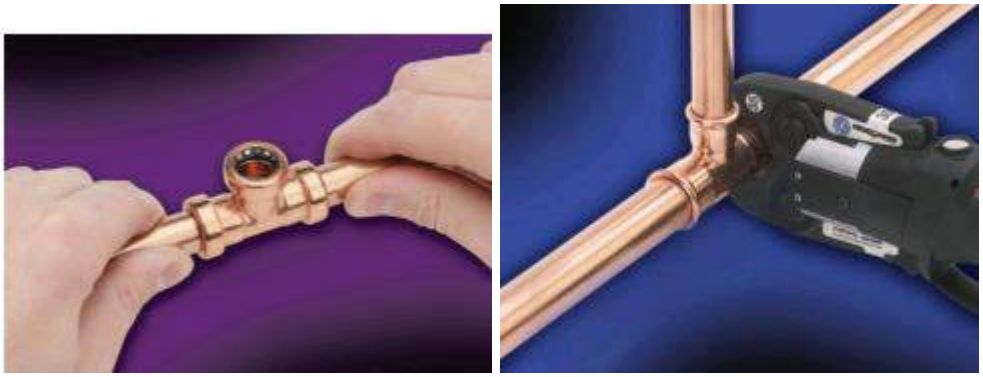


Figure 2.35 Push fitting copper pipe

Copper to copper push fit systems

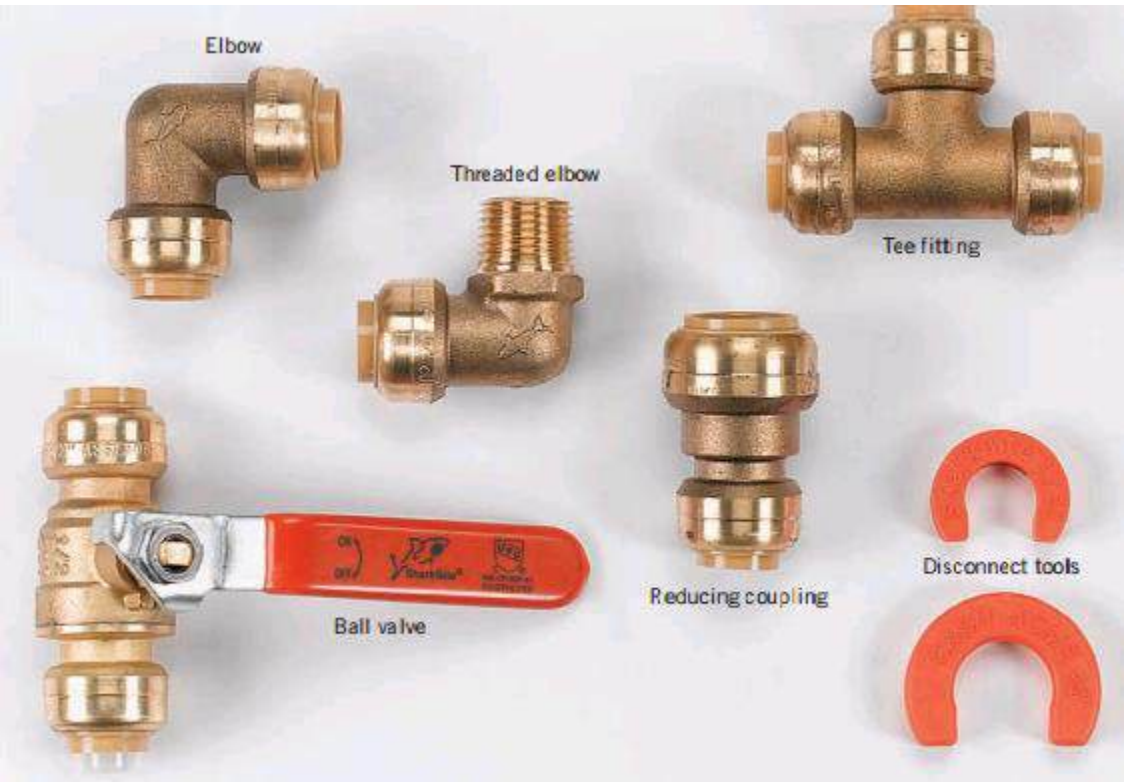


Figure 2.36 Fitting of copper pipe

Steps of joining push fitting

- Cut the pipe square, and remove any burrs and rough edges.
- Push the pipe into the fitting an inch or until you hear click.
- To remove a pipe from a push fitting, slip the disconnect tool over the pipe, slide it over the fitting, and press against the fitting's release collar as you pull the pipe out.

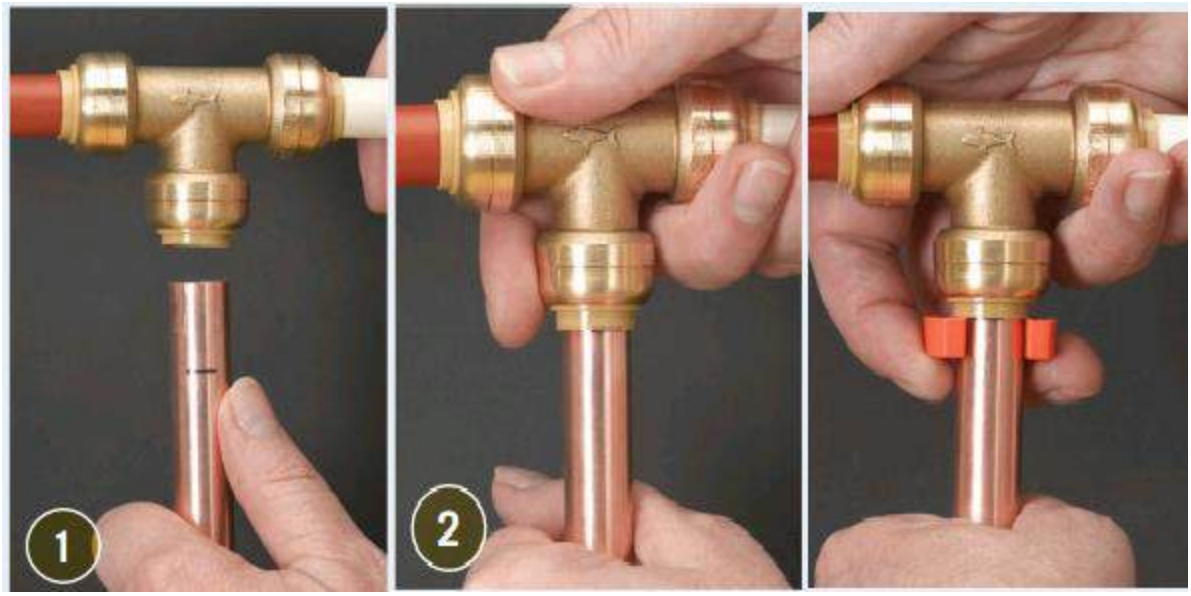


Figure 2.37 Joining fitting in copper pipe

2.7.9 Bending of copper pipe

Setting out for copper pipe bends using a machine bender

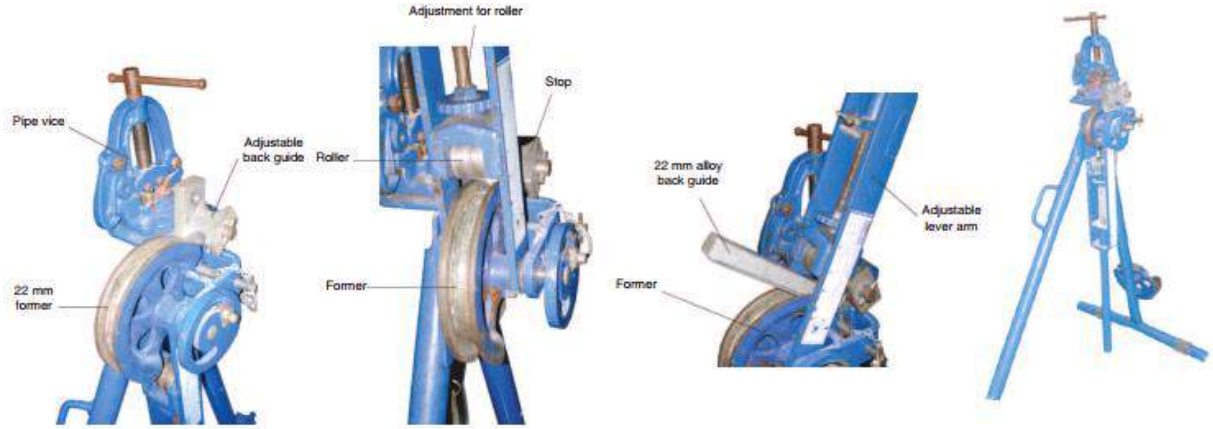


Figure 2.38 Steps in bending of cupper pipe

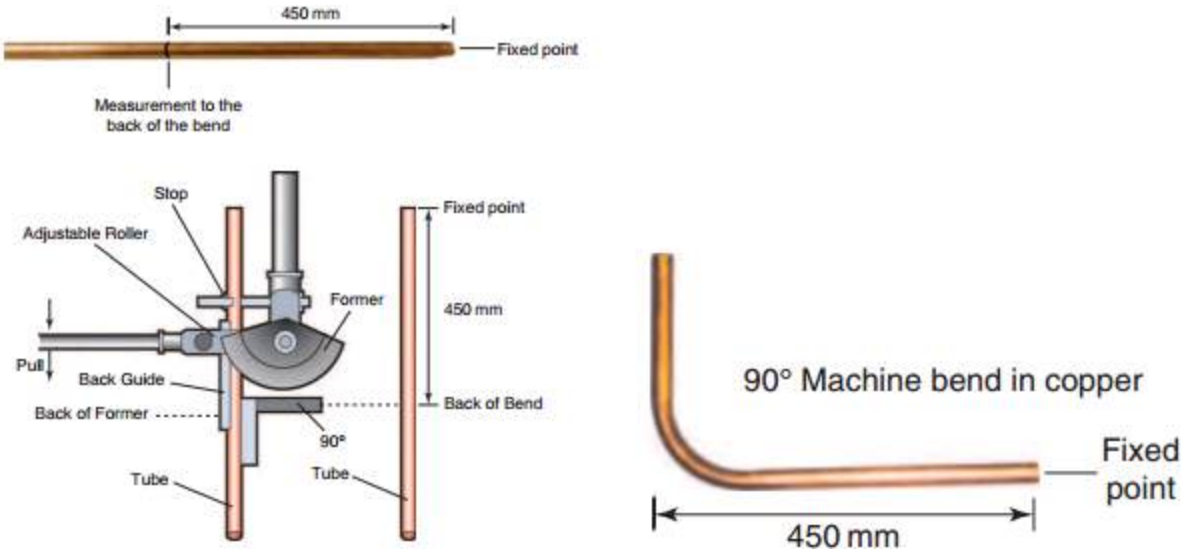


Figure 2.39 Measurements and process of bending copper pipe

2.7.10 Installation of water supply line using copper

- Remove the subfloor completely in the installation area if you are running new supply lines inside the floor cavity.
- Secure the supporting area of pipe.
- When soldering copper, tack a piece of metal flashing between wall studs behind the work area to serve as a heat shield
- Use reducing tees to tap into branch supply lines.
- Use a tubing cutter to remove sections of branch supply lines.
- Drill access holes directly into installation area to allow supply risers to fix. The holes should align with access holes for the risers in the subfloor
- Use a small level to make sure unattached riser pipes are plumb when marking cutting lines on mating horizontal branch lines
- Dry-fit line, whether the new pipes are copper or CPVC.

Figure 2.40 Copper pipe system installations

2.8 PEX Installation

PEX supply tubing offers a number of advantages over traditional rigid supply tubing:
Easy to install and good insulation (it use mechanical connections no require joint, solvents or soldering), easy to transport, quiet, good for retrofit jobs, and high freeze resistant.

A-Female adapter, B-Reducer female adapter, C-Female adapter union, D-Female adapter union elbow, E-Drop ear elbow, F-'/z PEX x '/z female thread union, G-Hose bibb (with threaded washer to the right), H-PEX to sweat adapter, I-Crimpers, J-Connector for refrigerator water supply (in-line, with tube below), K-Plastic coupling, L-Connector for refrigerator water supply (end of line, with tube below), M-Stop valve, male thread, N-Plastic T, O-Cap, P-Reducer T 1/2X1/2X3/4, Q-Brass coupling, R-Reducer coupling, S-Reducer T 3/4X1/2 X 3/4, T-Reducer male adapter, U-Elbow, V-Reducer elbow.

Figure 2.41 Most commonly used PEX fittings

Follow the guidelines below when installing PEX:

1. Cut the pipe to length, making sure to leave enough extra material so the line will have a small amount of slack once the connections are made.
2. Inspect the cut end to make sure it is clean and smooth.
3. Insert the barbed end of the fitting into the pipe until it is snug against the cut edges.
4. Align the jaws of a full-circle crimping tool over the crimp ring and squeeze the handles together to apply strong, even pressure to the ring.
5. Test the connection to make sure it is mechanically acceptable, using a go/no-go gauge. If the ring does not fit into the gauge properly, cut the pipe near the connection and try again.

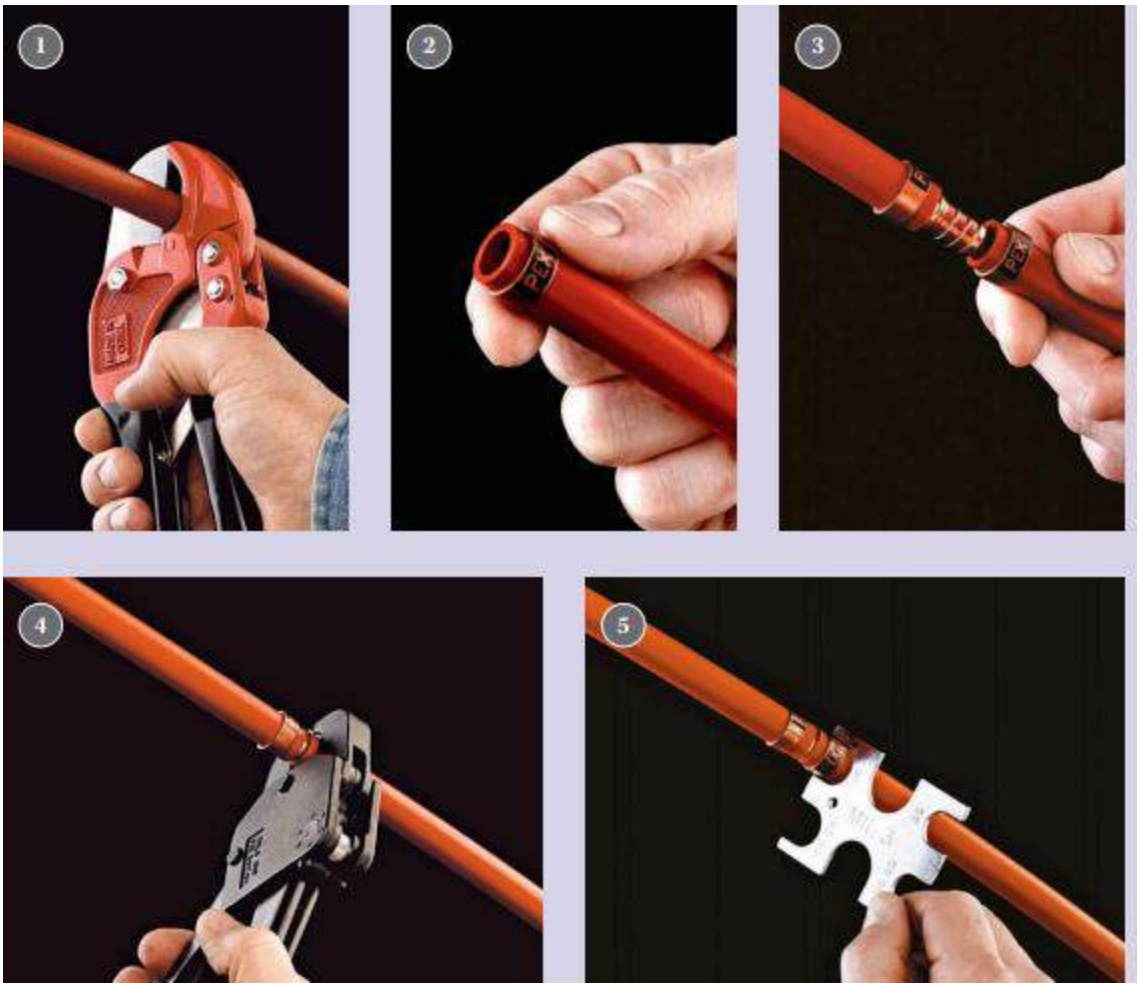


Figure 2.42 Steps of installing PEX

2.9 Plastic Pipe and Fittings

Plastic piping is lightweight and rigid or flexible (similar to copper tubing). It is easily joined and is corrosion resistant. Plastic pipe can be used for water or waste systems. It is used for hot or cold-water piping and for drain, waste, and vent piping.

2.9.1 Types and Sizes

Plastic pipe is classified by the acronym for the type of material from which it is made.

Polyvinyl Chloride (PVC): PVC pipe is cream or white and used only for cold-water pipelines, sanitary drainage, and venting. Diameter sizes range from 1/2 inch to 6 inches.

CPVC: CPVC pipe is light or cream and used for both cold and hot water pipelines. Diameter sizes are 1/2 inch and 3/4 inch.

ABS: ABS pipe is black or gray and used for above and below ground sanitary drainage and venting. Diameter sizes range from 1 1/4 to 6 inches.

Polybutylene (PB): PB pipe is black or dark gray and used for cold water lines. Diameter sizes range from 3/4 inch to 2 inches. It is costly, requires special fittings, and is not widely used.

Polyetylene (PE): PE pipe is black and used for cold-water lines and sprinkler systems. Diameter sizes range from 3/4 inch to 2 inches.

2.9.2 Fittings

Fitting sizes for PVC and CPVC piping are similar to steel and copper fittings; however, joining is usually done with epoxy or plastic sealants, rather than threading or soldering.

A-Street 4S, B-45, C-Street go, D-go, E-Orop ear elbow; glue on both sides, F-Cap, G-Orop ear elbow, H-Union, I-Brass FIP by glue-on, J-Standard T, K-Reducing bushing, L-FIP plastic, M-Brass male adapter, N-Brass FIP, O-Plastic male adapter, P-CPVC by PVC glue-on, Q-Reducing coupling, R-Coupling, S-Brass MIP by union glueon, T-Compression by union glue-on, U, V, and W-Reducing Ts

Figure 2.43 Most commonly used CPVC fittings

2.9.3 Measuring and Cutting Plastic Pipe

Step 1. Determine the length of pipe required and mark the spot for cut.

Step 2. Place the pipe in a miter box or jig and cut the pipe with a hacksaw or a fine-tooth handsaw. Use a miter box to get a square cut.

Step 3. Remove burrs from both the inside and the outside of the pipe with a pocketknife. If a pocketknife is not available, use sandpaper.

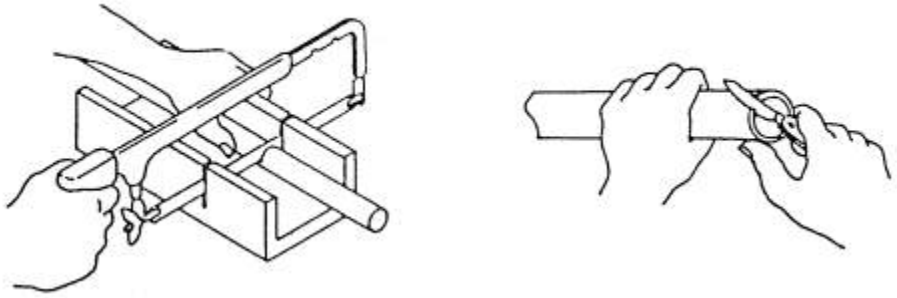


Figure 2.44 Steps of Cutting Plastic Pipe

2.9.4 Joining

Solvent-Cement Weld Joint

This joint is made by using a cleaning primer and solvent cement on the pipe and fitting. Solvent cement consists of plastic filler dissolved in a mixture of solvents. Use the appropriate solvent cement for the type of pipe being used. The solvent cement melts the pipe and fitting to weld them together. Since solvent cement sets fast, pipe joint is completed quickly.

Use the following steps to join plastic pipe with solvent cement:

Step 1. Inspect the pipe end for burrs and the fitting for cracks.

Step 2. Clean the pipe and the inside of the fitting with an authorized cleaning primer, using a clean rag.

Step 3. Coat the outside of the pipe end and the inside of the fitting with solvent cement.

Step 4. Push the pipe as quickly as possible into the fitting as far as it will go. A small bead of cement will be visible.

Step 5. Give the fitting a quarter turn to spread the solvent cement.

Step 6. Hold the joint connection for about 30 seconds to be sure it is solidly set.

Step 7. Wipe off all excess cement.

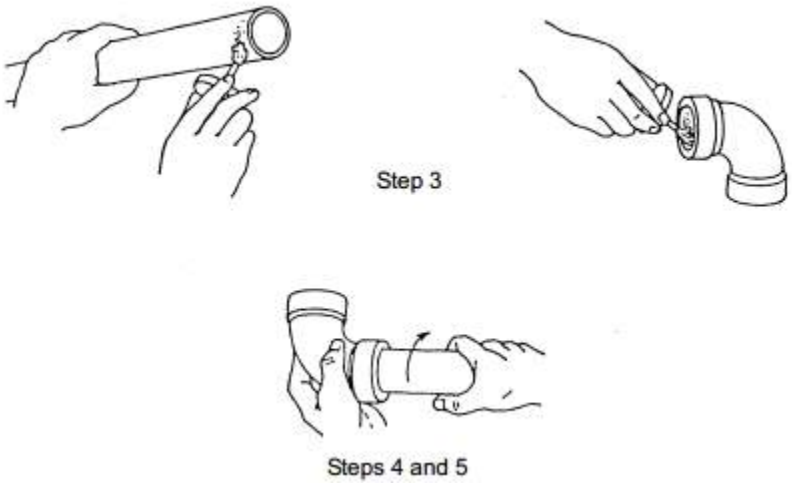


Figure 2.45 Steps of Joining Plastic Pipe

2.9.5 Cutting Rigid Plastic Pipe

- Mark the length on the pipe with a felt-tipped pen.
- Use fast and neat plastic tubing cutters.
- The best cutting tool for plastic pipe is a power miter saw with a fine tooth woodworking blade or a plastic-specific blade.
- A ratcheting plastic-pipe cutter can cut smaller diameter PVC and CPVC pipe in a real hurry.

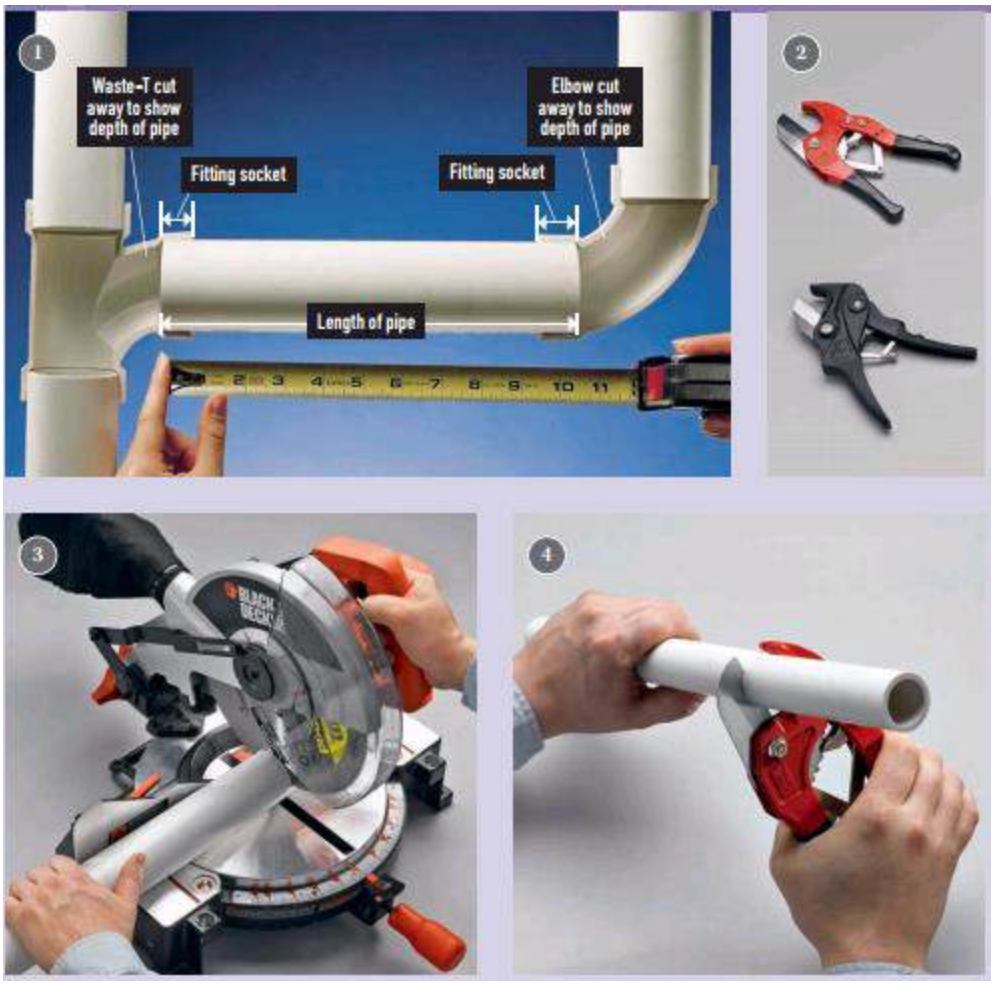


Figure 2.46 Steps of Cutting Plastic Pipe

Using solvent‑Glue on rigid plastic pipe

1. Remove rough burrs on cut ends of plastic pipe, using a utility knife or deburring tool.
2. Test-fit all pipes and fittings. Pipes should fit tightly against the bottom of the fitting sockets.
3. Mark the depth of the fitting sockets on the pipes.
4. Apply a light coat of plastic pipe primer to the ends of the pipes and to the insides of the fitting sockets.
5. Solvent-cement each joint by applying a thick coat of solvent cement to the end of the pipe.
6. Quickly position the pipe and fitting so that the alignment marks are offset by about 2". Force the pipe into the fitting until the end fits flush against the bottom of the socket.

7. Spread solvent by twisting the pipe until the marks are aligned.
8. Hold the pipe in place for about 20 seconds to prevent the joint from slipping.
9. Wipe away excess solvent cement with a rag.

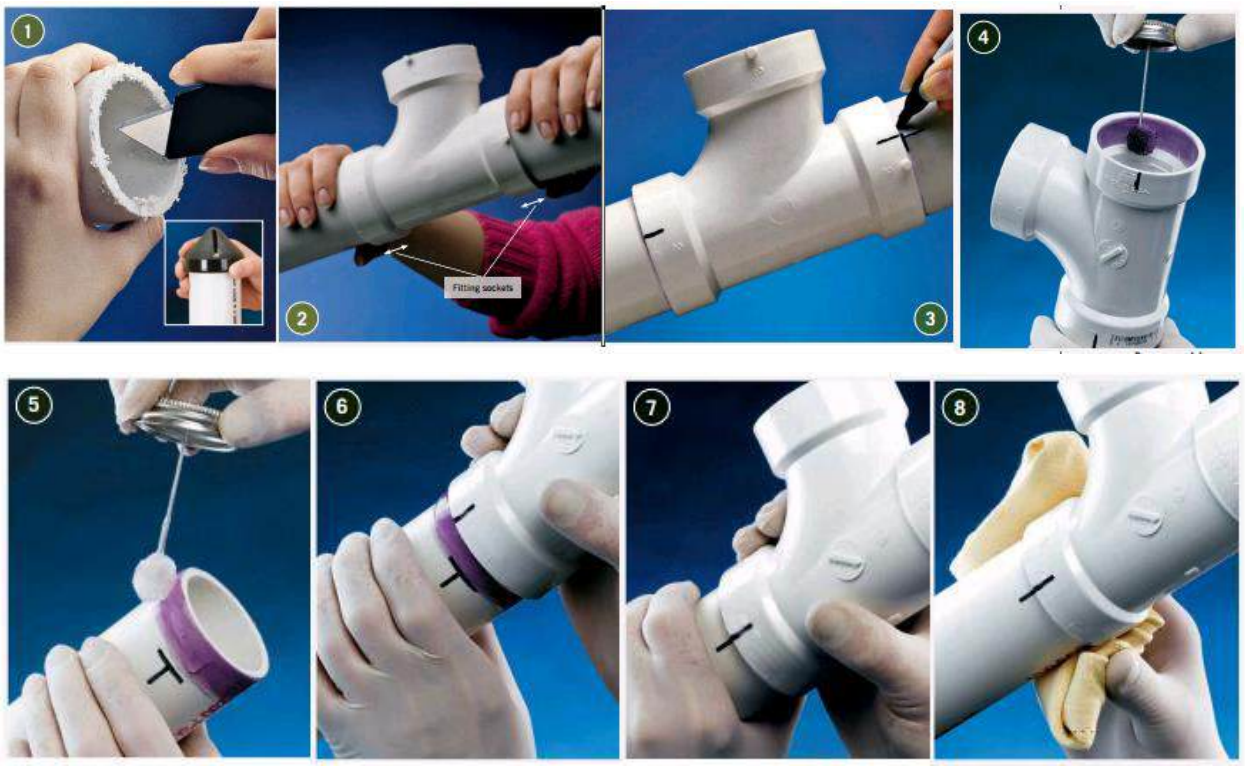


Figure 2.47 Steps of glue plastic pipe

Installation of Basement Bath using rigid plastic pipe

- Wear a dust mask, hearing protection, and eye protection and Prepare and clean working area
- Replace the entire sweep elbow where the drain stack joins the sewer line. The union in the new sweep should have an opening to accommodate the new drain line.
- After you've made all your new drain line connections, test the line by dumping water down the risers to make sure there are no leaks. Then, cover the new drain lines with a course of drainage rock followed by a layer of fresh concrete that's at least 4" thick.

Figure 2.48 Steps of Installation of Basement Bath using rigid plastic pipe

2.9.6 Flexible plastic pipe

Flexible PE (polyethylene) pipe is used for underground cold water lines. Very inexpensive, PE pipe is commonly used for automatic lawn sprinkler systems and for extending cold water supply to utility sinks in detached garages and sheds. Unlike other plastics, PE is not solvent‑glued, but is joined using "barbed" rigid PVC fittings and stainless steel hose clamps. In cold climates, outdoor plumbing lines should be shut off and drained for winter.

Use the following steps to join flexible plastic pipe:

1. Cut flexible PE pipe with a plastic tubing cutter, or use a miter box or sharp knife. Remove any rough burrs with a utility knife.
2. Fit stainless-steel hose clamps over the ends of the flexible pipes being joined.
3. Slide the band clamps over the joint ends. Hand tighten each clamp with a screwdriver or wrench

Figure 2.49 Steps to join flexible plastic pipe

2.9.7 Plastic pipe push fit systems

This joint is made by sliding and clamping flexible plastic pipe onto an insert fitting (as shown in the Figure 2.50).

Figure 2.50 Push joint in plastic fitting

Use the following steps to join push fit plastic pipe:

Step 1. Slide a clamp over the flexible pipe.

Step 2. Push the pipe on to the insert fitting to the last serration.

Step 3. Slide the clamp over the pipe and tighten the clamp with a screwdriver.

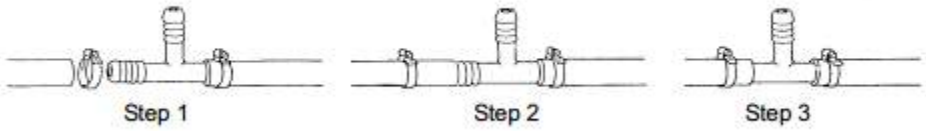


Figure 2.51 Steps of joining push joint in plastic pipe

2.10 Taps and valves used in water plumbing systems

Taps or fittings are usually made of brass pressings or castings, and chrome-plated to enhance appearance and improve ease of cleaning. Plastic taps and valves are also available. These are manufactured from thermosetting plastic of acetal.

Taps and valves must be sufficiently strong to resist normal and surge pressure, sasily accessible to renew seals and washers, made of corrosion-resistant materials, and capable of working at appropriate temperatures.

2.10.1 Taps used for supplying sanitary appliances (sinks, baths, wash basins and bidets)

Standard pattern taps

There is a vast range of taps used for sanitary appliances, and with the exception of the ceramic disc-type taps, all work on the same principle. Maintenance requirements of taps Since there is a vast range of tap designs, it would be impossible toshow every type and their maintenance requirements.The seating is where the washer ‘seats’ on the body of the tap when turned into the off position. This stops any water from passing through. Sometimes, the seating deteriorates due to fatigue and wear. A re-seating tool can be used to grind the seating smooth again and provide a good seal between the body of the tapand the washer.The servicing requirements of both cold and hot taps are really the same thing, it is just the isolation of and turning on the supply that is slightly different.

Figure 2.52 (a) Pillar tap components (b) Pillar tap seating and washer

2.10.2 Valve and Hose

Valves make it possible to shut off water at any point in the supply system. If a pipe breaks or a plumbing fixture is gins to leak, you can shut of water not flow to the damage pipe, so that it can be repaired. A hose bib is a faucet with a threaded spout, often used to connect rubber utility or appliance hoses. Valves and hose bibs leak when washers or seals wear out. Replacement parts can be found in the same universal washer kits used to repair faucets. Coat replacement washers with heat proof grease to keep them soft and prevent cracking.

Figure 2.53 types of valves

Fix a Leaky Hose Bib

- Remove the handle screw, and lift of the handle.
- Unscrew the packing nut with an adjustable wrench.
- Unscrew the spindle from the valve body Remove the stem screw and replace the stem washer. Replace the packing washer, and reassemble the valve.

Figure 2.54 Components of hose bib

Classification of valves

External stop valves

The supply pipe to the building can be isolated from the main by installing an external stop valve. This enables the external supply to be isolated for maintenance and emergency reasons, so easy access to the stop valve is very important, as is keeping it in a good working condition. External stop valves for below ground use should be screw down type, valves complying with the standard.

Internal stop valves

The internal stop valve within a building must be:

- In an accessible position
- Fitted above the floor level
- As close as reasonably practicable to where the supply enters the building
- Prevent the flow of water to all distribution points within the building
- Well maintained so it's fully operational.

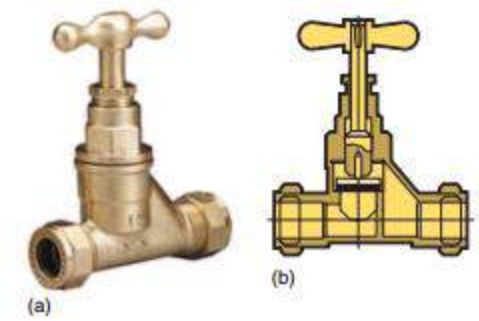


Figure 2.55 Stop valve

Other types of valve

Gate valve

Has a movable brass wedge, or "gate," that screw up and down to control water flow. Gate valves may develop leaks around the handle. Repair leaks by replacing the packing washer or packing string found underneath the packing nut. Figure 2.56 shows the component parts of a gate valve.

Component parts of a gate valve

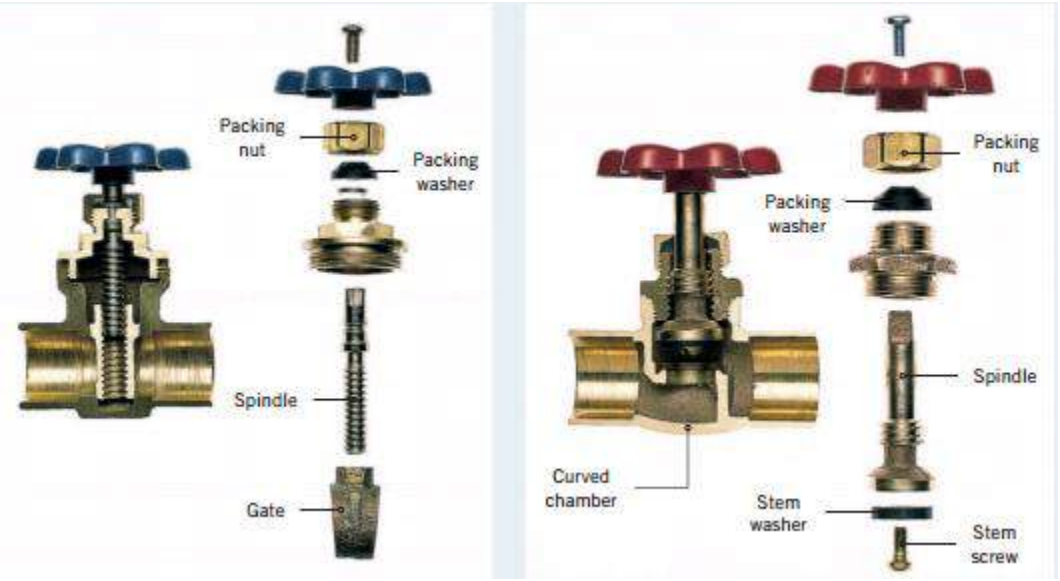


Figure 2.56 Gate valve

Globe valve

Has a curved chamber. Repair leaks around the handle by replacing the packing washer. If valve does not fully stop water flow when closed, replace the stem washer.

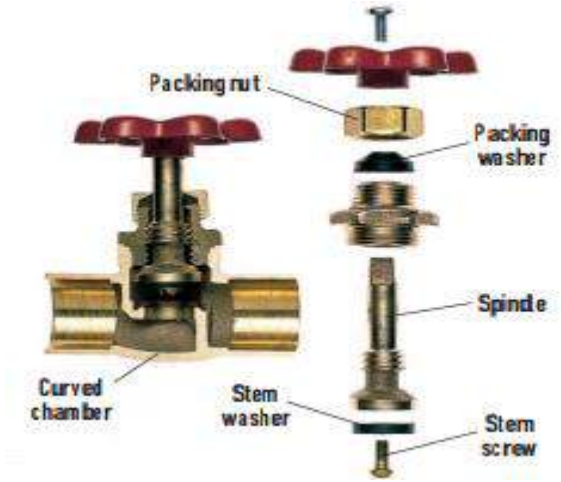


Figure 2.57 Global valve

Shutoff valve

Shut off valve is used to controls water supply to a single fixture. Shut off valve has aplastic spindle with a packing washer and a snap on stem washer. Repair leaks around the handle by replacing the packing washer. If valve does not fully stop water flow when closed, replace the stem washer.

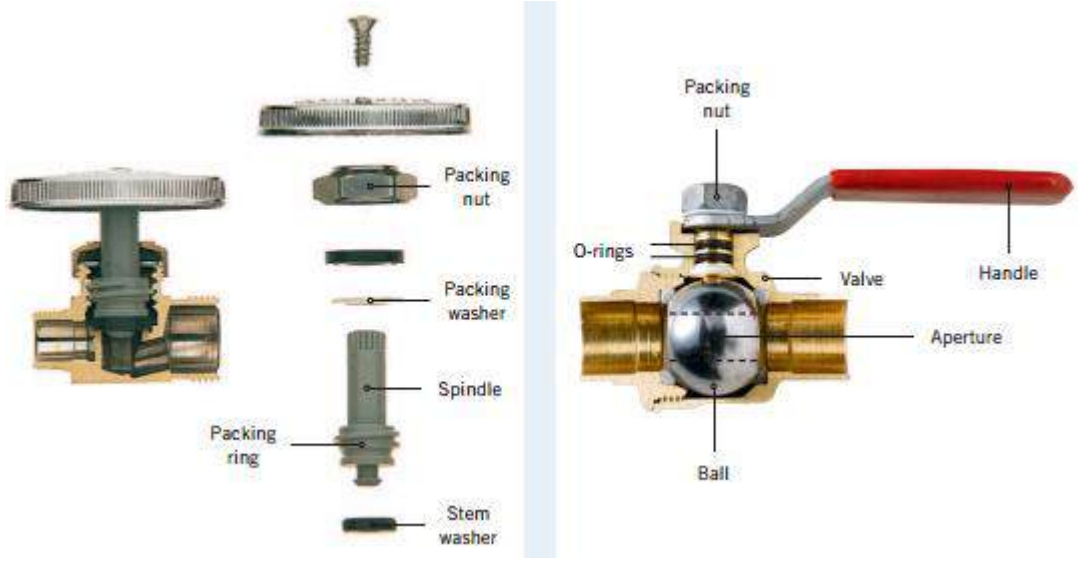


Figure 2.58 Shutoff valve

Saddle valve

It is a small fitting used to connect refrigerate or rice maker to sink-mounted water filter to a copper water pipe. Saddle valve contains a hollow metals pike that punctures water pipe when valve is first closed. Fitting is sealed with a rubber gasket. Repair leaks around the handle by replacing the ring under the packing nut.

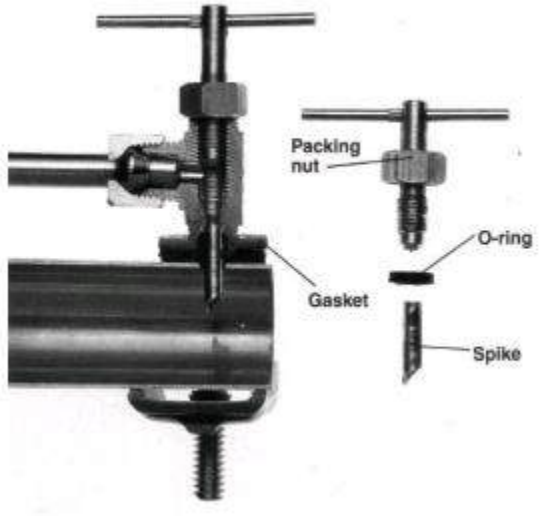


Figure 2.59 Saddle valve

Servicing valves

To conform to the requirements of the Water Regulations, inlet pipes to cisterns including WC cisterns must be fitted with a servicing valve immediately before connection to the cistern float valve. Servicing valves should also be fitted on outlet pipes, such as cold feed and distribution pipes. The valves should be installed in accessible positions, as close as reasonably practical, to the point of connection to the system (as shown in the Figure 2.60).

Figure 2.60 Three types of servicing valves

Check valves

The single check valve and a double check valve are used to prevent backflow and back siphon age and are installed to provide compliance with Water Regulations. The list below shows some typical applications where the Water Regulations require single and double check valves to be installed.

Single check valves: is connected prior to water softener, unvented heating systems, supply to wet sprinkler system, and downstream of meters and pressure reducing valves (no specific regulation but essential for correct operation of the equipment).

Double check valves: supply to hose taps, standpipes, and shower fitting.

Shower check valves: Supply to shower spray head where shower hose pipe is unconstrained, e.g. air gap requirement cannot be guaranteed.

Figure 2.61 Single and double check valves

2.10.3 Traps

Traps are mainly manufactured in plastic (polypropylene), although they are also available in copper or brass/chrome plated brass for use on copper pipework, where a more robust installation is required. Most trap fitting connections are either push-fit or compression-type.

Types of trap

The different types of trap are 'P', 'S', tubular swivel, bottle, straight through or wash basin, Hepworth discharge pipe valve, low-level bath, shower, running, and re-sealing trap

Tubular swivel traps

Tubular swivel traps are often used on sinks with multiple bowls because of their multi-positions, which provide a number of options when connecting to pipework. They are also particularly useful on appliance replacement jobs as they give more options when connecting to an existing waste pipe without using extra fittings or altering the pipework.

Figure 2.62 Tubular swivel traps

Bottle traps

Bottle traps are often used because of their neat appearance. They are easier to install in small areas such as behind a wash basin. They should be avoided on sink as they are prone to cause food blockage.

Figure 2.63 Bottle traps

‘**P’ and ‘S’ traps**

‘P’ or ‘S’ traps are so named due to their shape, they are available in tubular design, or with a joint connection (as shown in the Figures 2.64), which have a few additional features useful when fixing them to pipework and fittings.

‘P’ traps are often used where the waste pipe is installed directly through a wall from the appliance and into a drain or directly into a stack. The ‘S’ trap would be used where the pipe has to go vertically from the trap through a floor or into another horizontal wastepipe from another appliance. ‘P’ traps and bottle traps can be converted to ‘S’ traps using swivel elbows.

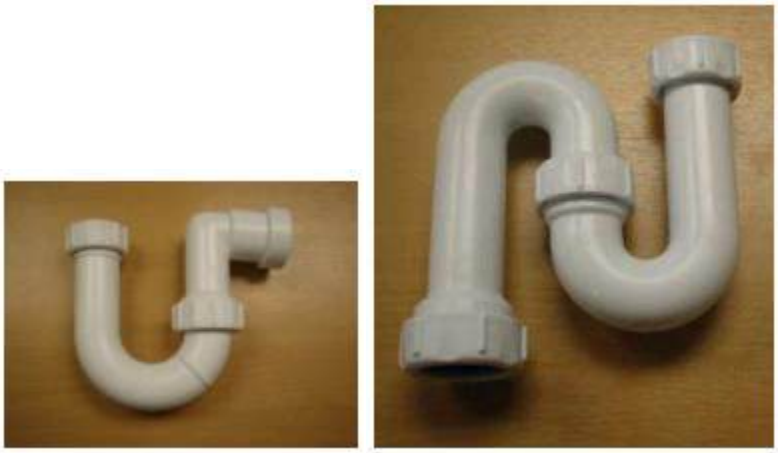


Figure 2.64 P’ and ‘S’ traps

Hepworth discharge pipe valve

The Hepworth valve works on the simple principle of using an internal plastic membrane. The membrane allows water to flow through it when the water is released, then closes to prevent foul air from entering the building.

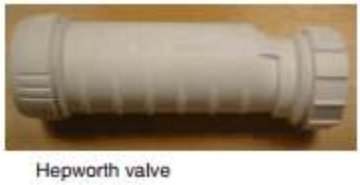


Figure 2.65 Hepworth discharge pipe valve

Low-level bath traps, bath traps and shower

These are designed so they can fit in tight spaces under baths and shower trays. Some of these traps are shallow traps, i.e. they only have a seal, which means they would need to have a separate ventilating pipe in practice, though a plumber would fit an anti-siphon version of the shallow trap.

Figure 2.66 Low-level bath traps

Straight through or wash basin trap

Wash basin traps are used as an alternative to 'S' trap where space is limited. They are also easier to hide behind pedestal basins. The main problem with this design is the two tight bends which slow down the flow of water.

Figure 2.67 Wash basin trap

Running traps

It used in public toilets or schools where one running trap is used for a range of un trapped wash basins. On domestic installations it could be used in cases where a 'P' or 'S' strap arrangement is not possible or is difficult to achieve due to limitation of space or an obstruction. Running traps are sometimes used with a washing machine waste outlet or dishwashers, although specialist traps are also available for these appliances.

Figure 2.68 Running traps

Resealing and anti-siphon traps

These types of traps could be specified or fitted in situations where normal installation requirements cannot be met. This type has a bypass within the body of the bottle. A dip pipe allows air to enter the trap via the bypass arrangement. As the seal is lost due to siphon age, air is allowed into the trap, thereby breaking the siphonic effect.

Figure 2.69 Anti-siphon traps

Trap failure

The reasons that a trap fails are usually down to bad design which can lead to self or induced siphon age, but it may be down to natural causes such as evaporation or foaming. Below are three of the main causes of trap failure.

- Self-siphon age
- Induced siphon age
- Compression

Self-siphon age

As the water discharges, a plug of water is formed. This creates a partial vacuum (negative pressure) in the pipe between the water plug and the basin, which is enough to siphon the water out of the trap. Self-siphon age can be prevented by ensuring that the length of waste pipe is within the regulations for single stack installations, or that the waste pipe is ventilated. Self-siphon age is most common in wash basins as its shape allows water to escape quickly.

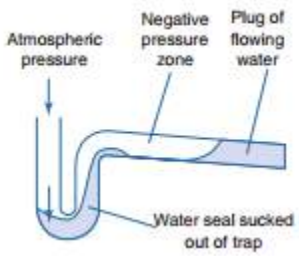


Figure 2.70 Self-siphon age

Induced siphon age

This is caused by the discharge of water from an appliance which is connected to the same waste pipe as other appliances. As the water plug flows past the joints of the second appliance, a negative pressure is created between the pipe and appliance which siphons the water out of the trap. This arrangement is not acceptable on a primary ventilated stack, unless the final branch pipe is a size bigger than the largest diameter waste pipe from the appliance.

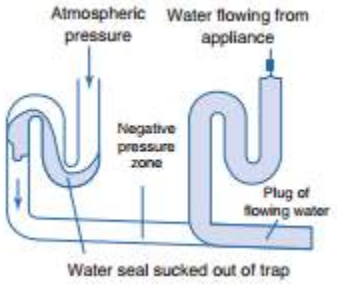


Figure 2.71 Induced siphon age

Compression

In Figure 2.72, you can see that as the water is discharged from an appliance into the main stack (usually WC at first floor level), it compresses at the base of the stack, causing back pressure. The back pressure can be enough to force the water out of the trap, thus loosening the seal. The use of large radius bends and the small length between the vent of the drain and lowest branch pipe are in the regulations in order to prevent this.

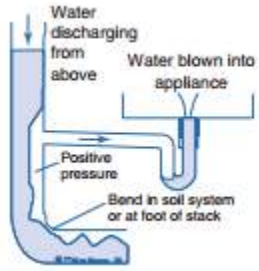


Figure 2.72 Compression

Other trap-related problems

Evaporation

This is the most common form of natural seal loss, which happens in very warm and dry weather, but is unlikely to occur in traps with a 75 mm seal.

Wavering out

This is caused by the effects of wind pressure across the top of the soil and vent pipe, particularly in exposed locations. This causes the water in the trap to produce a wave movement and wash over the weir of the trap. It does not happen often and can be avoided by fitting a 90° bend or a cowl to the top of the vent pipe.

Foaming

Foaming occurs when excessive detergent has been discharged into the sanitary system. The buildup of foam in the wastepipe can cause depletion of the water seal in the trap.

Momentum

This is blowing the seal of a trap with the force of water and can happen if a bucket of water is poured forcefully into a sink or toilet.

Capillary action

This only occurs in 'S' trap arrangements, and does not happen often. If a thread of material becomes lodged, water could be drawn from the trap by the effect of capillary attraction.

Self-Check 2	Written Test

Instructions: Answer the following questions listed below

1. What is the advantage of using PEX installation? (3pts)
2. Write at least 3 types of trap failure? (3pts)
3. What is the use of copper fitting? (4pts)
4. Write at least 3 types of valves? (3 pts)
5. Mention the 5 common fitting styles? (3 pts)
6. List at least 4 plastics type of pipes? (4 pts)
7. What are the joint types in copper? (2 pts)
8. State the three common methods of pipe lengths measurement? (3 pts)

OPERATION SHEET-2

OPERATION TITLE:- Identify installation requirements

PURPOSE:-

Able:

To determine plumbing installation requirement and installation

To give care the types/quality of plumbing work, prevent damage of water supply and know methods and standard of pipe layout.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-

- ✓ Safe working area environment
- ✓ Ensure the work shop hazard free
- ✓ Ensure the working area is bright / good visibility
- ✓ Availability of proper tools and equipments
- ✓ To gate enough accessory
- ✓ Handling to use wrench.
- ✓ Use Joints
- ✓ Conducting test procedures.
- ✓ Maintain pipe system

EQUIPMENT TOOLS AND MATERIALS : -

PVC Pipe Cutter ,Pipe Die Stock, Copper Fitting, Pipe Die ,Teflon Tape, PEX Crimp Tool and ABS Cement

Wrench, pipe cutters, chalk lines, hammers, marking equipment, measuring tapes, de-burring, reamer, stock head, dies, diestock, signage, cold chisel, soil-pipe cutter, tubing cutter, fine-tooth hacksaw, heating torch, nonacid solder, soldering flux, machine bender, miter box or jig, and pocketknife

PROCEDURE,

- ✓ Secure workshop manuals, Specifications, and tools and equipment;
- ✓ Prepare the workstations for installation works;
- ✓ Select appropriate methods based available materials
- ✓ Select appropriate safety tools and equipments

- ✓ Observe the proper application of Occupational Health and Safety requirements.
- ✓ Follow the instruction and done the work
- ✓ Cute pipes according the required
- ✓ Joining and Fix components and Fastening Solutions range that meet the Highest Quality Standards
- ✓ Install pipe system considering the standard
- ✓ Connecting and placing piping components
- ✓ Applying Test Procedures.
- ✓ Repairing and maintaining damaged pipe lines

PRECAUTIONS:-

- ✓ Wear appropriate clothes, shoe, glove, goggle...
- ✓ Make working area hazard free
- ✓ Ensure the working area is bright / good visibility
- ✓ Able to make workstation comfortable
- ✓ Read and interpret manuals, plans, specifications and drawing components.

QUALITY CRITERIA:

Assured the performance of all the activities according to the given guide.

Information Sheet-3	Drainage Installation

3. DRAINAGE INSTALLATION

3.1 Introduction

Drainage installation of a plumbing system is subdivided into three parts namely: **Drainage, Waste and Vent** or simply **called DWV.**

1. The Drainage Pipe refers to the installation, which receives and conveys water closet discharges with or without waste coming from other fixtures.
2. The Waste Pipe refers to that installation which conveys discharges of fixtures other than water closet such as lavatories, slop sinks, urinals, bathtubs and other similar fixtures to soil branch, soil stack or house drain.
3. The Vent Pipe of a plumbing system functions as air passage or conduit to ventilate the drainage and waste pipe installation.

3.2 Plumbing Fixtures:-

Plumbing fixtures are receptacles intended to receive water, liquid or water-carried waste and discharge them into the drainage system. Plumbing fixtures comes in varieties of style and accessories designed to match with the room for cosmetic reasons. Associated to this, it is important that plumbing fixtures must be of the best quality, carrying the name or brand of reputable manufacturers because quality fixtures are specially designed and built to take a lot of abuse and yet expected to last for years. Quality however, is always associated with cost. Comparatively, cheaper fixtures wear out faster than those which cost higher but proven to be good quality.

3.3 Type of Fixtures

1. Bathtub (bath, foot, and bidet)
2. Lavatories (wall hung, pedestal and two piece)
3. Water Closet
4. Urinals (pedestal, stall, and trough)

5. Showers (Single stall and Gang)
6. Sink (kitchen, pantry, scullery, laundry, and slop)

3.4 Bath (bath, and foot)

Bathing as an activity is becoming gregarious. Bathtubs are large enough to accommodate couple bathing together are flowing in the market. Even the traditional one person bathtub is equipped with seats, shelves for soap and shampoo. The lightest bathtub introduced is the Fiberglass tubs.

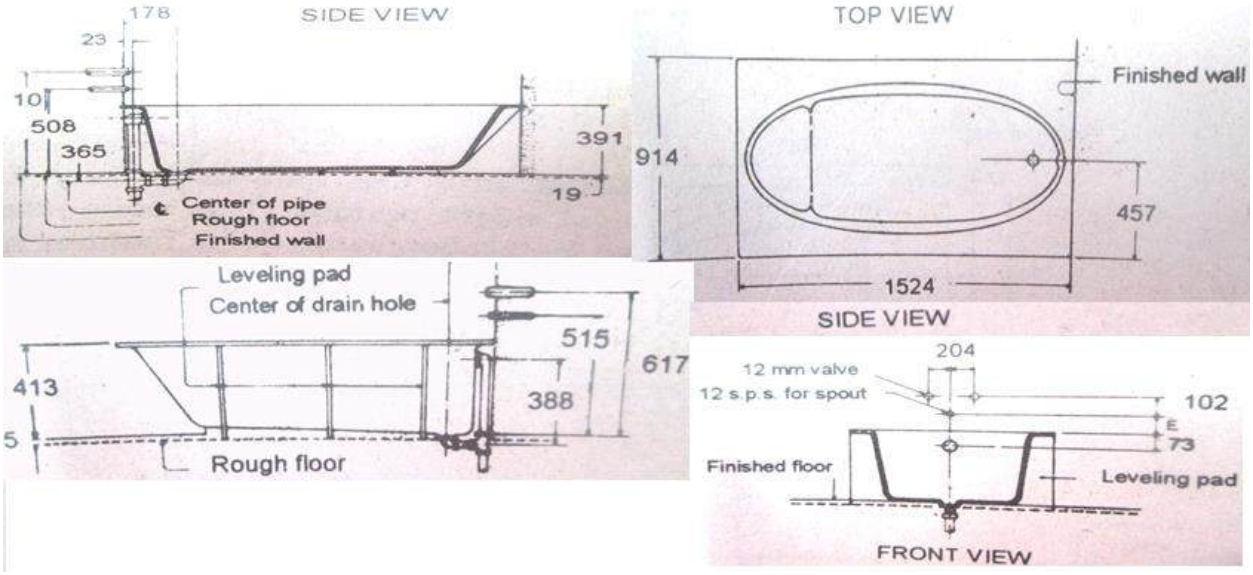


Figure 3.1 standard dimension of bath

3.4.1 Type bath

A variety of built-in bathtubs is available. They are designed to be recessed for corner installation of square, rectangular, and angled tubs and tubs with one or more ledge seats. Tubs are made of enameled cast iron or steel and fiberglass. The different types of bathtub are:

Rectangular bath

A standard rectangular bath is still the most popular and economical design. Baths vary in size from 1.5 to 1.8m (5 to 6ft) in length, with a choice of widths made from 700 to 800mm (2ft 4in to 2ft 8in).

Figure 3.2 Rectangular bath

Corner bath

A corner bath actually occupies more floor area than a rectangular bath of the same capacity, but because the tub is turned at an angle to the room it may take up less wall space. By virtue of its design, a corner bath usually provides some shelf space for essential toiletries.

Figure 3.3 Corner bath

Round bath

A round bath is likely to be impractical in most bathrooms but if you are converting a spare bedroom, you may decide to make the bath a feature of the interior design as well as a practical appliance. Once a bath is fitted close to the wall, it can be difficult to make the joints and connections - so fit the taps, overflow and trap before you push the bath into position.

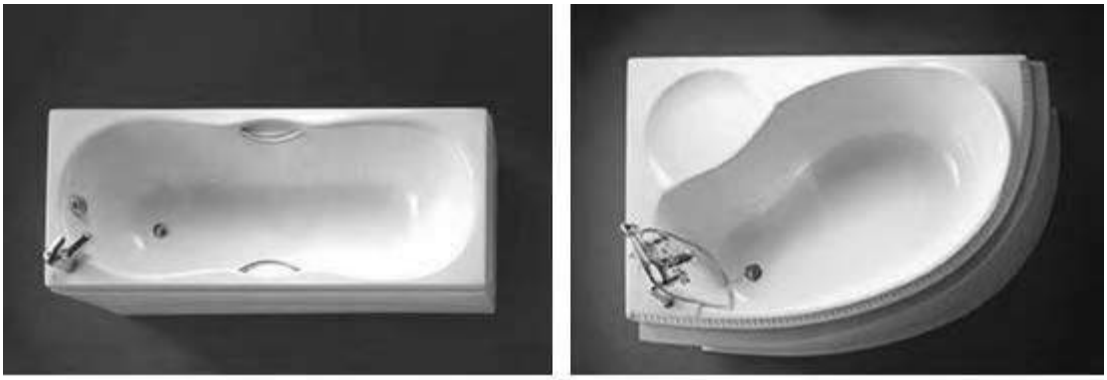


Figure 3.4 Round baths

3.4.2 Installing of bath

Slide new bath into position and adjust the height of the feet with a spanner. Use a spirit level to check the rim is horizontal. Adjust the flexible tap pipes and join them to the supply pipes. Connect a 40mm (l1/2in) waste pipe to the trap and run it to the external hopper or soil stack, as for a washbasin. Before fixing the bath panels, restore the water supply and check for leaks.

Figure 3.5 Bathtub

Modern cast-iron tubs are designed to rest on the floor and fit against the wall framing (studs). They need no wall support, except that steel tubs have flanges supported by l- by 4-inch boards, nailed to the studs. Use a waterproofing cement to caulk the joint between the finished wall surface and the tub. Mount the over-rim tub filling, with or without a shower diverter, on the wall at one end of the tub. The drain may be the pull-out or pop-up type. Install removable service panel in the wall behind the tub to provide access to the trap and the water supply valve.

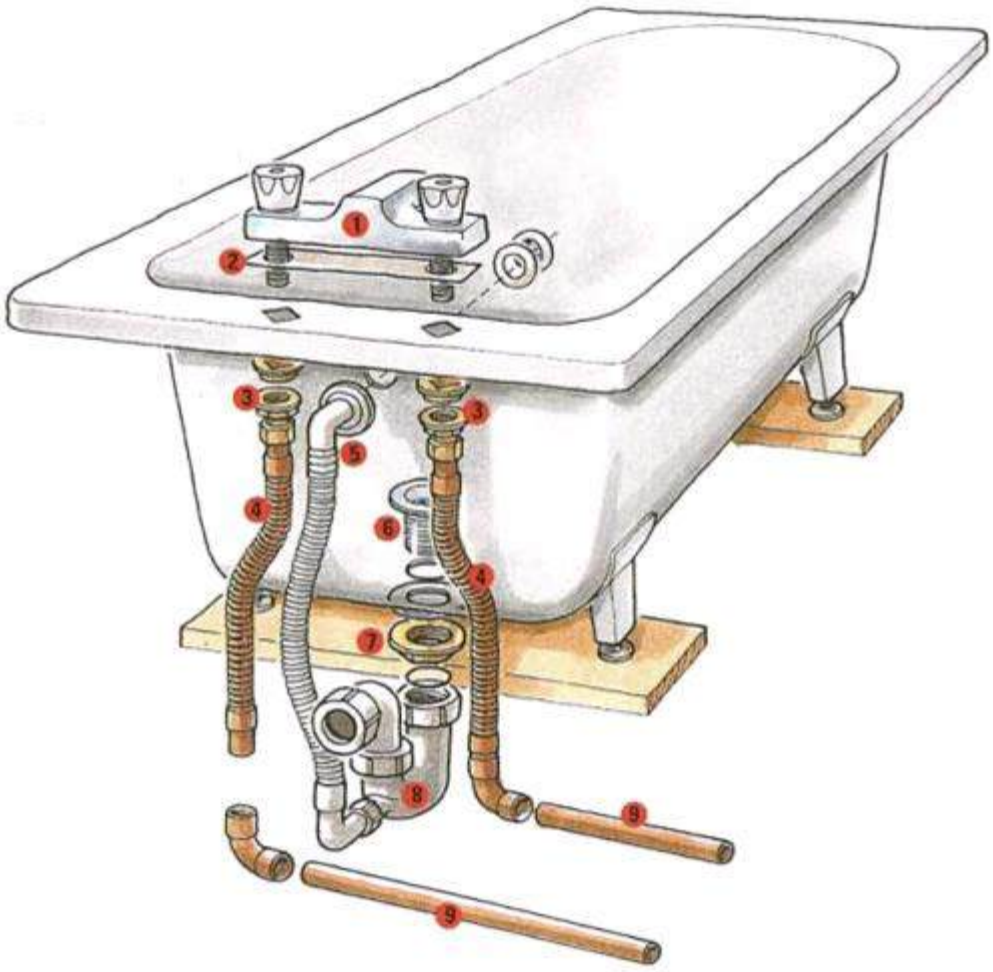


Figure 3.6 Components of bathtub

Plumbing bath

1. Mixer tap
2. Mixer-tap gasket
3. Mixer back-nut and washer
4. Flexible copper pipe
5. Overflow unit
6. Waste outlet
7. Waste back-nut and washer
8. Deep-seal trap to 40mm (11/2in)
9. Supply pipe 22mm(3/4 in)

Detailed Steps of Installation of Bathtub

- Begin by installing the new water supply plumbing. Measure to determine the required height of your shower riser tube and cut it to length. Attach the bottom of the riser to the faucet body and the top to the shower elbow.
- Attach the faucet body to the cross brace with pipe hanger straps. Then, attach supply tubing from the stop valves to the faucet body, making sure to attach the hot water to the left port and cold to the right port.
- Mark locations for ledger boards. To do this, trace the height of the top of the tub's nailing flange onto the wall studs in the alcove. Then remove the tub and measure the height of the nailing flange.
- Install the drain-waste-overflow (DWO) pipes before you install the tub. Make sure to get a good seal on the slip nuts at the pipe joints.
- Thread the male-threaded drain strainer into the female-threaded drain waste elbow. Wrap a coil of plumber's putty around the drain outlet underneath the plug rim first. Hands tighten only.
- Attach the overflow cover plate, making sure the pop-up drain controls are in the correct position. Tighten the mounting screws that connect to the mounting plate to sandwich the rubber gasket snugly between the overflow pipe flange and the tub wall. Then, finish tightening the drain strainer against the waste elbow by inserting the handle of a pair of pliers into the strainer body and turning.
- Attach the drain outlet from the DWO assembly to the drain P-trap. This is the part of the job where you will appreciate that you spent the time to create a roomy access panel for the tub plumbing.
- Install fittings. First, thread the shower arm into the shower elbow and attach the spout nipple to the valve assembly. Also attach the shower head and escutcheon, the faucet handle/diverter with escutcheon, and the tub spout. Use thread lubricant on all parts.

Figure 3.7 Steps of Installation of Bathtub

3.4.3 Checking and Maintenance of bath

Check the bathtub: - Check whether dripping after the bathtub filled with water. Bath installation checking is important, not only need to meet use standard, if there is any leakage accidents will bring trouble to you. So bathtub checking should be divided into two phases:

First, should take water testing several times after installation is finished. Flushing is unobstructed, look around if there is leakage or no.

Second, Bathtub outfall should be directly connect with drain, avoid connect by plastic hose, not to make an open trench drain away water and the place against the wall may come out fine draw after a long time service for human body overloading and Water dynamic load.

Steps to clear bathtub P-trap stoppages,

Step 1.Remove the stopper linkage and the overflow cover.

Step 2.Push a 1/4 to 1/2-inch drain snake into the overflow opening until it meets some resistance.

Step 3.Turn the snake using a push-pull motion until it turns freely.

Step 4.Remove the snake and run water through the drain to check if the stoppage is cleared.

Step 5.Replace the overflow cover and linkage.

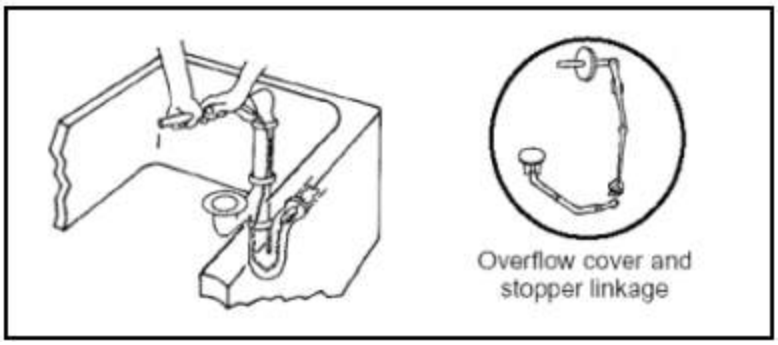


Figure 3.8 Clear bathtub P-trap stoppages

Steps to clear drum-trap stoppages

Step 1.Remove the drum-top cover and gasket and push a 1/4- to 1/2-inch snake into the trap's lower line to search for the stoppage.

Step 2.If a stoppage exists, clear it.

Step 3.If there is no stoppage in the lower line, remove the snake and push it into the upper line.

Step 4.Turn the snake with a push-pull action to remove the stoppage and replace the gasket and cover.

Step 5.Run water through the drain to see if the stoppage is cleared.

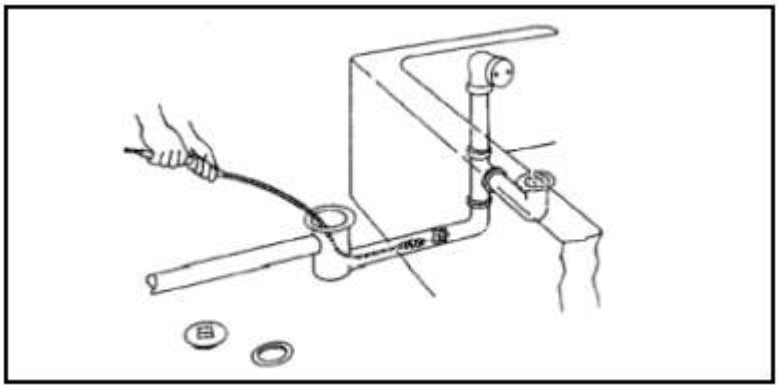


Figure 3.9 Clear drum-trap stoppages

Cleaning and Adjesting Plunger-Type Drain

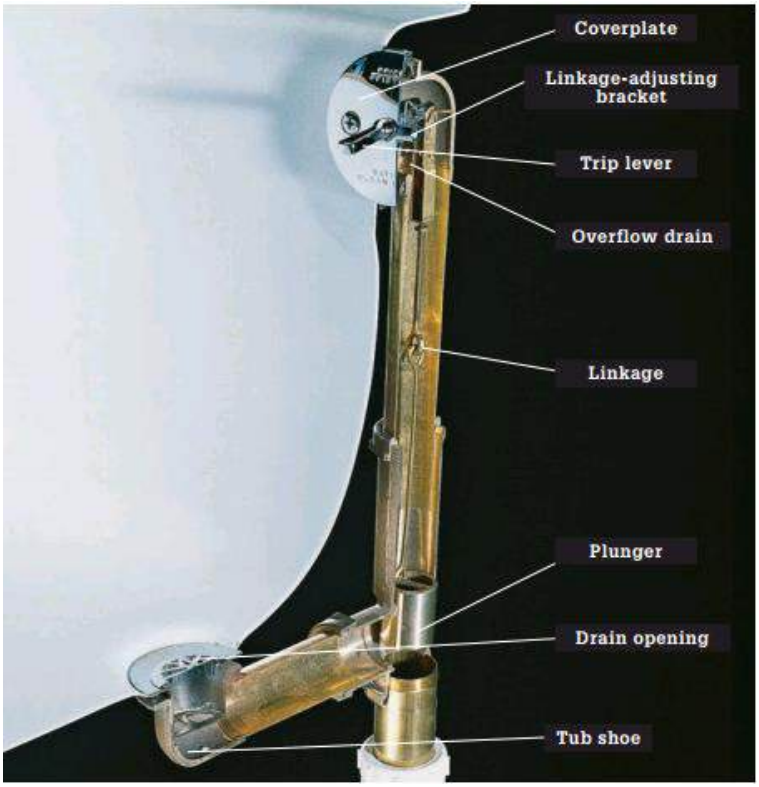


Figure 3.10 Detailed compenets of plunger

- A plunger-type tub drainhas a simple grate over the drain opening
- Clean hair and soap off the plunger
- Adjust the plunge

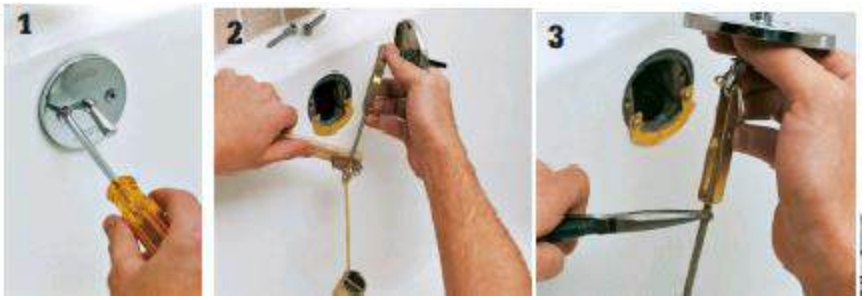


Figure 3.11 Cleaning of plunger

Clean and adjust Pop-up Drain

- Raise the trip leverto the open position
- Remove the screws from the cover plate
- Adjust the pop-up stopper mechanism

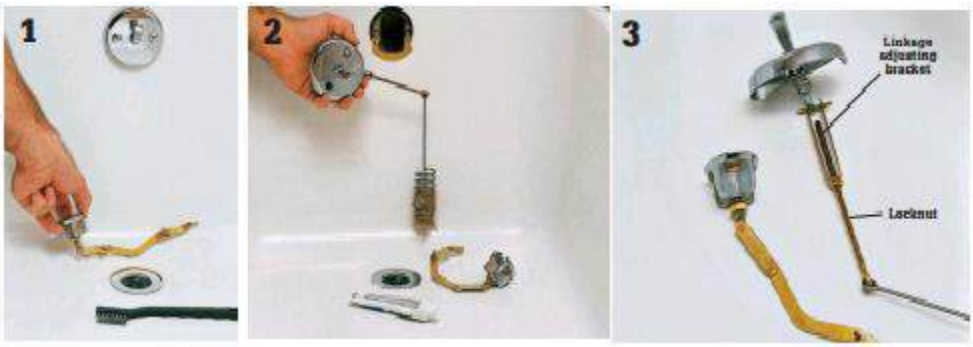


Figure 3.12 Cleaning of Pop-up

3.4.4 Removing an old bath

If a cast-iron bath is beyond restoration and therefore worthless, it is easier to break it up in the bathroom and carry it out in pieces. Drape a dust sheet over the bath; then, wearinl gloves, goggles and ear protectors, smash it with a heavy hammer. Hack the old overflow from the wall with a cold chisel, then fill the hole with mortar and repair the plasterwork.

3.5 Bidet

The bidet is designed for cleanliness of the localized parts of the body, and it serves for many purposes. It used for clear habit for men, women, and children. Its frequent application is advisable for comfort and health and in keeping with a mode of sanitary living. The bidet is equipped with valves for both hot and cold water and with a pop-up type waste plug either for retaining the water or for draining as desired. The inside walls of the bowl are washed by a

flushing rim that uses the same basic principle of operation as the toilet bowl; however, the bidet is intended to carry away human waste material. Bidet also serve as a footh bath or for any function that a lower set of bowl might perform. Bidet is much more closely related to a shower than to toilet, although it appears more likely as toilet bowl.

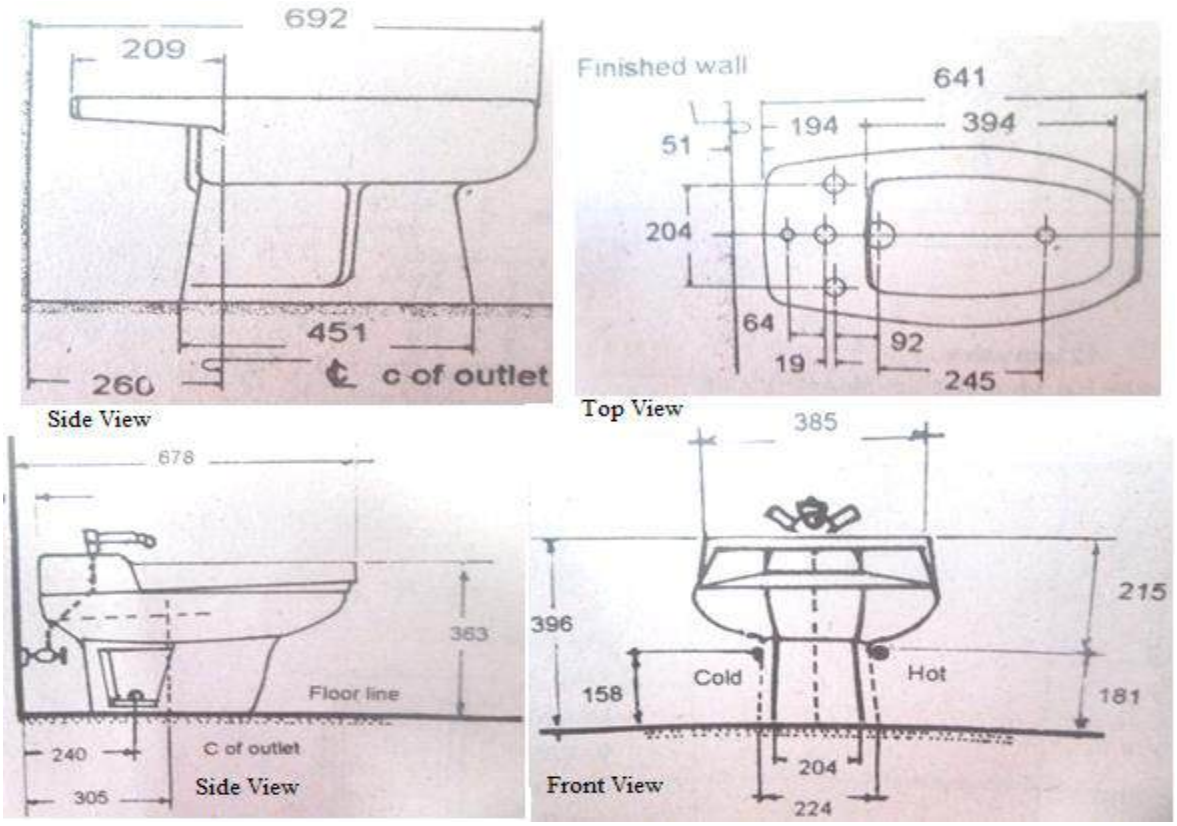


Figure 3.13. Standard dimensions of bidet

3.5.1 Types of Bidet

Over-rim-supply bidet

This type of bidet is simply a low-level basin. It is fitted with individual hot and cold taps or a basin mixer, and has a built-in overflow running to the waste outlet in the basin. The disadvantage with an over-rim bidet is the rim is cold when you sit astride it.

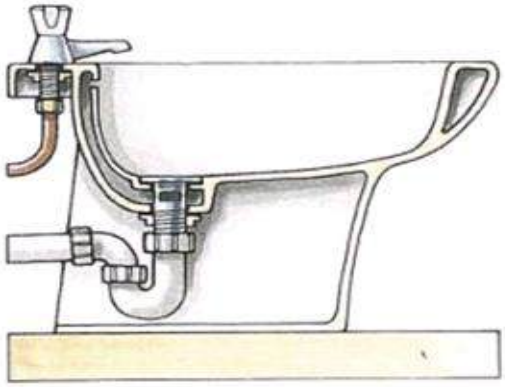


Figure 3.14 Components of over-rim-supply bidet

Rim-supply bidet

Rim is more sophisticated bidet delivers warm water to the basin by a hollow rim. Consequently, the rim is preheated and comfortable to sit on. A special mixer set with a douche spray is fitted to this type of bidet. It incorporates the normal hot and cold valves, but a control in the center of the mixer diverts water from the rim to the spray head mounted in the bottom of the basin. Because the spray head is submerged when the basin is full.

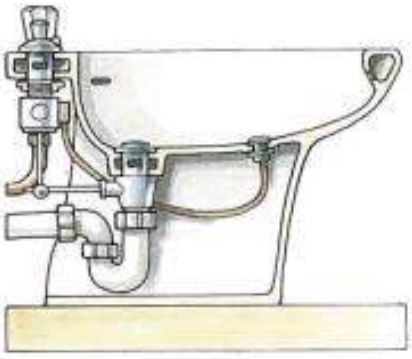


Figure 3.15 Components of rim-supply bidet

3.5.2 Installing a bide

When plumbing an over-rim-supply bidet, use exactly the same procedures, pipes and connectors described for plumbing a washbasin. Fit the taps waste outlet and trap, then use a spirit level to position the bidet before fixing it to the floor with non-corrosive screws and rubber washers. Supply the hot and cold taps with branch pipes from the existing bathroom plumbing, and take the waste pipe to the hopper or stack. When attaching the bidet set and trap to a rim-supply appliance. Screw the bidet to the floor before running supply pipes and waste according to the

Water Regulations. Connect the cold supply to the tank at the same level as the existing supply pipe. The procedure is described here below:

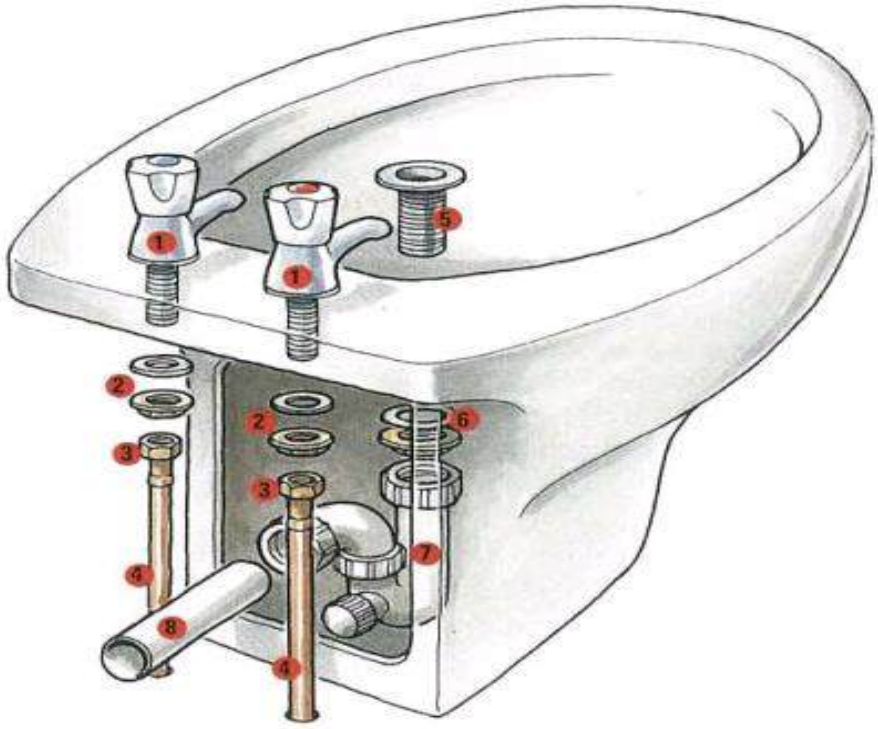


Figure 3.16 Components of bidet

Plumbing an over-rim-supply bidet

1. Tap
2. Tap back-nut and washer
3. Tap connector
4. Supply pipe 15mm (1/2 in)
5. Waste outlet
6. Waste back-nut and washer
7. Trap
8. Waste pipe

Detailed Installation of Bidet

Materials

Figure 3.17 Materials for bidet installation

Detailed Installation of Bidet

- Rough in supply and drain lines according to the manufacturer's specifications.
- Apply a roll of plumber's putty around the underside of the drain flange
- Install the pop-up drain apparatus according to the manufacturer's instructions.
- Place the bidet in its final location, checking that supply and drain lines will be in alignment.
- Remove the bidet and drill 3⁄16" pilot holes at the marks on the floor.
- Connect the water supply risers to the bidet faucet using compression unions.
- Hook up the drain line by attaching the P-trap to the drain tailpiece.

- Remove the aerator so any debris in the supply line will clear and then turn on the water and open both faucets. Check for leaks in lines and fix, if found. Assemble the bolt caps and thread them onto the floor bolts.

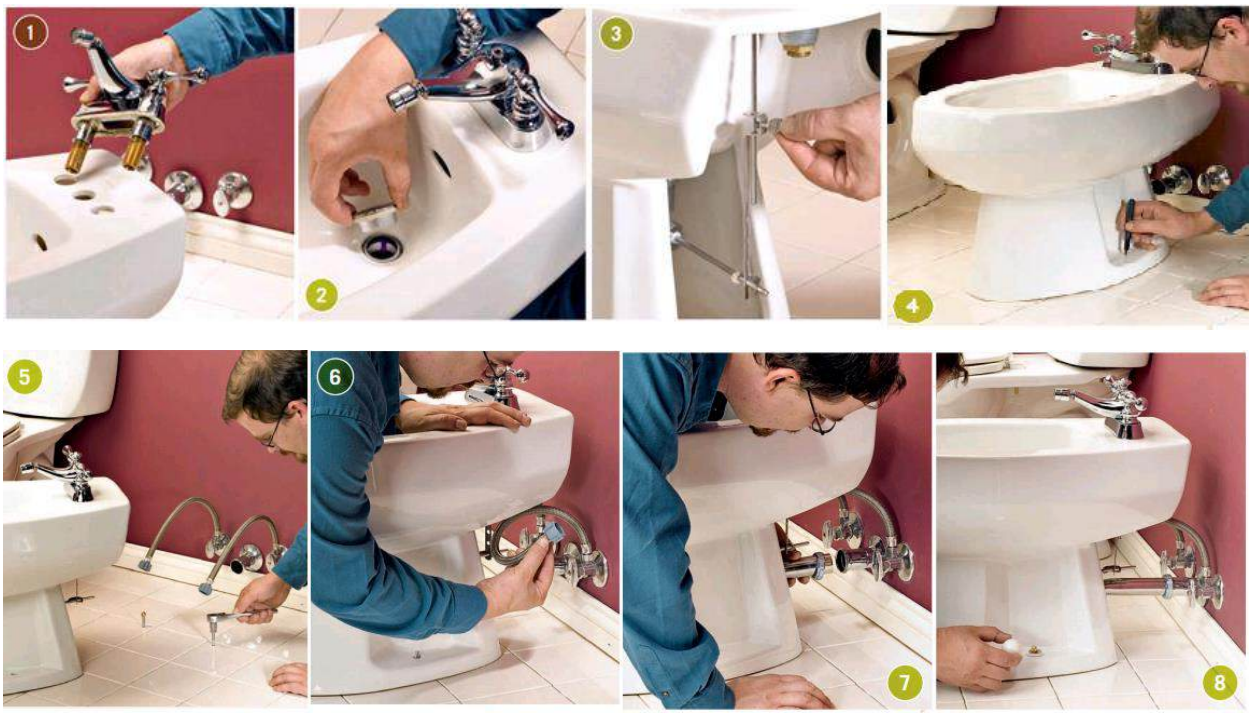


Figure 3.18 Steps in Installation of Bidet

3.6 Lavatories/hand washbasins (HWB)

A lavatory is designed for washing hands and face. Lavatories come in a variety of shapes, sizes, and colors. They are made of vitreous china, enameled cast iron, stainless steel, and plastic. Hot and cold water is supplied through the supply system and the waste drains into the sanitary sewer.

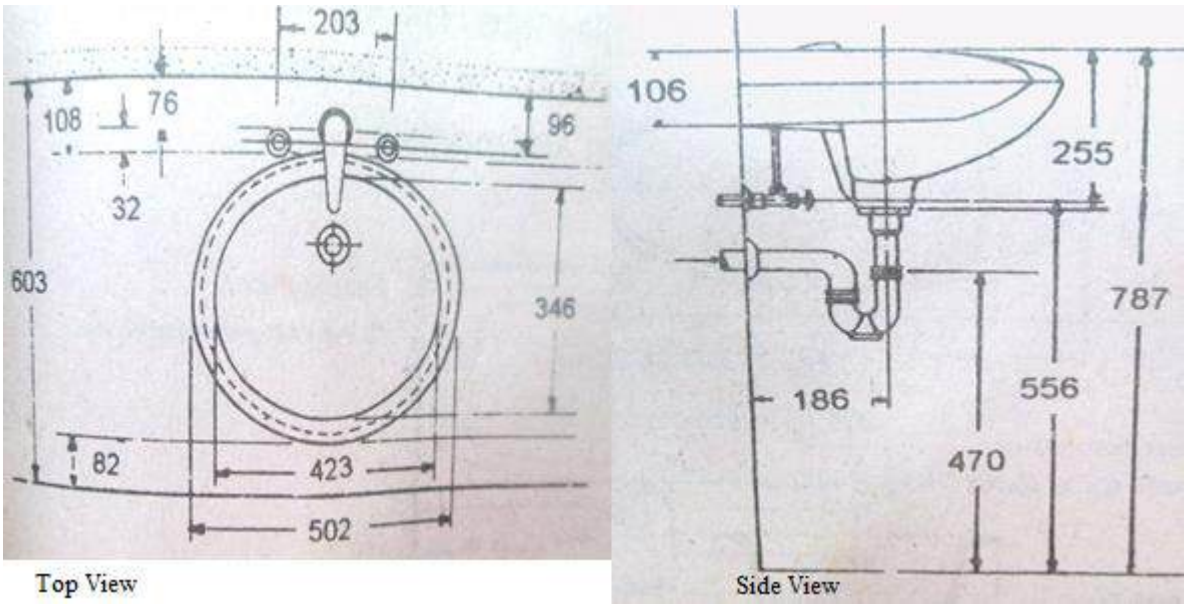


Figure 3.19 Detailed dimension of lavatory

3.6.1 Types of Lavatories/hand washbasins

Whether modifying existing plumbing or running pipework to a new location, fitting a washbasin in a bathroom or guest room is likely to present few difficulties provided you give some thought to how you will run the waste to the vertical stack. With carefully designed pipe runs, it should be possible to plumb your house without a single pipe being visible. For this reason there are different types of lavatories which describe here below:

Pedestal basins

The hollow pedestal provides some support for the basin and it conceals the unsightly supply and waste pipes.

Figure 3.20 Pedestal basins

Wall-hung basins

Older wall-hung basins are supported on large screw-fixed brackets, but a modern concealed mounting is just as strong provided the wall fixings are secure. Check that you can screw into the studs of a timber-frame or hack off the lath and plaster and install a mounting board or wall. If you want to hide pipes, consider some form of paneling.

Figure 3.21 Wall-hung basins

Wall hung HWB installation

Use the following steps to install a wall-hung lavatory

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.

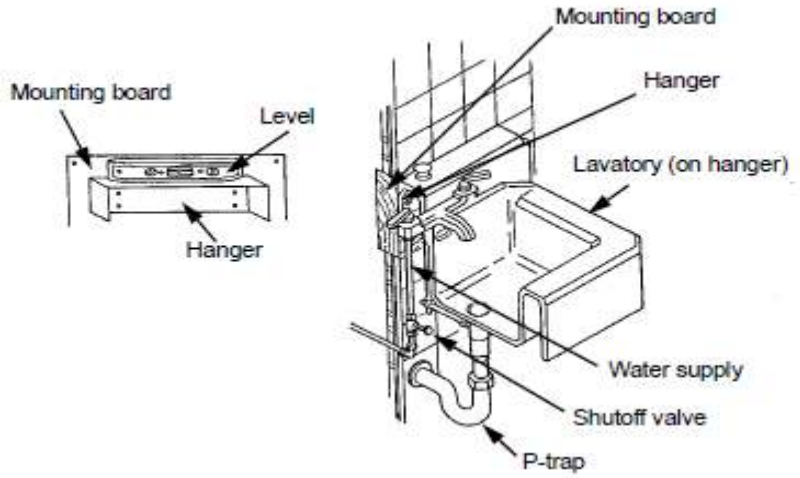


Figure 3.22 Wall-hung lavatory installations

Corner basins

Hand basins that fit into the corner of a room are space-saving, and the pipe- work can be run conveniently through adjacent walls or concealed by boxing them in across the corner.

Figure 3.23 Corner basins

Recessed basins

In a cloakroom or WC where space is very limited, a small hand basin can be recessed into one of the walls. Also, you can recess a standard basin to conceal the plumbing.

Figure 3.24 Recessed basins

Counter-top basins

In a large bathroom or bedroom, you can fit a washbasin or pair of basins into a counter top as part of a built-in vanity unit. Cupboards below provide ample storage for towels and toiletries, while also hiding the plumbing.

Figure 3.25 Counter-top basins

3.6.2 Lavatory installation

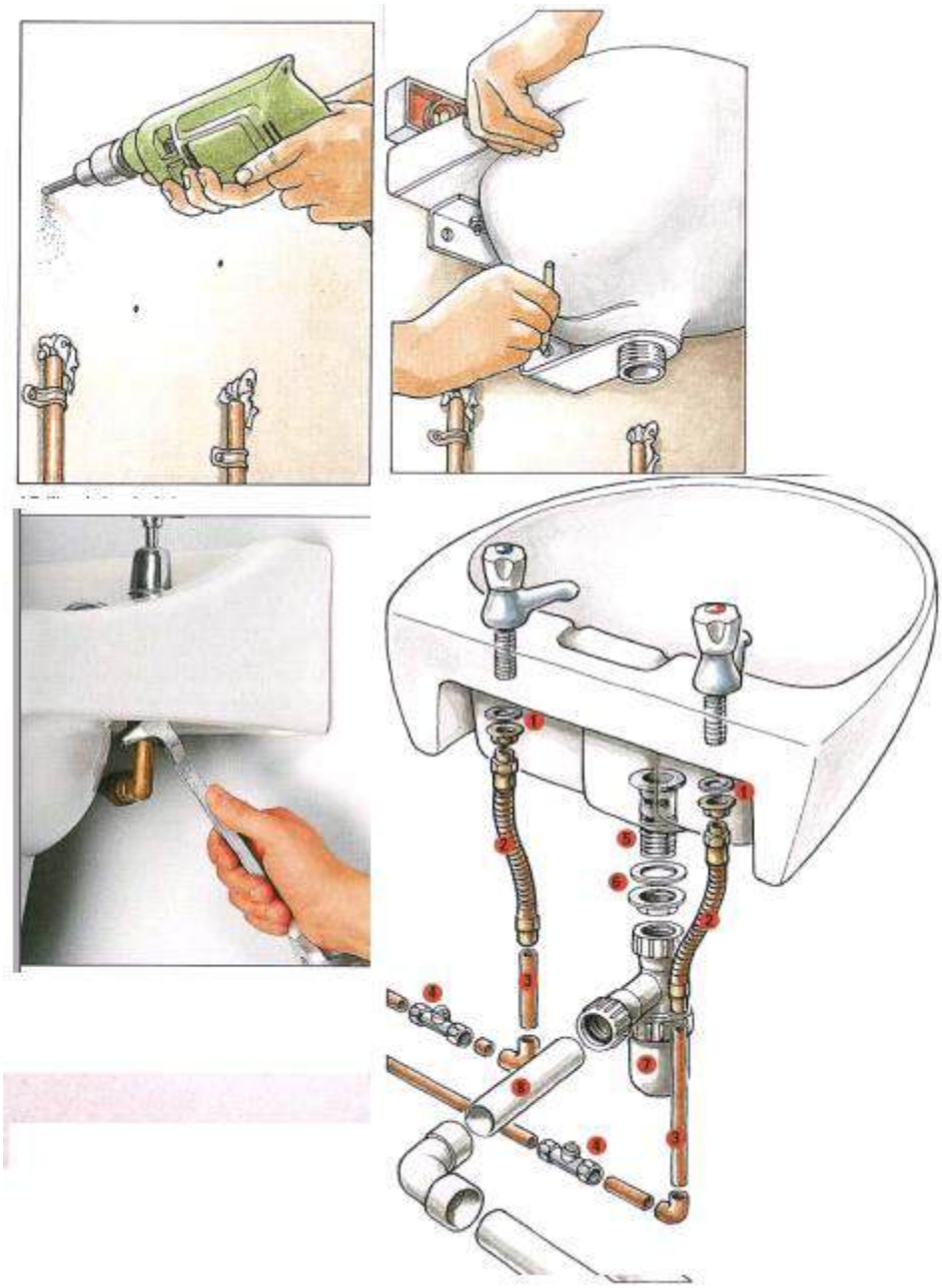


Figure 3.26 Lavatory installation

Plumbing a washbasin

1. Top back-nut and washer
2. Flexible copper pipe
3. Supply pipe

4. Isolating valve
5. Waste outlet
6. Waste back-nut and washer
7. Bottle trap
8. Waste pipe

Install a Pedestal Sink

1. Install blocking between the wall studs
2. Set the basin and pedestal in position and brace
3. Set aside the basin and pedestal.
4. Attach the faucet, and then set the sink on the pedestal.
5. Hook up the drain and supply fittings.

Figure 3.27 Install a Pedestal Sink

3.6.3 Lavatory faucets installation

Use the following steps and Figure 3.28 to install faucets:

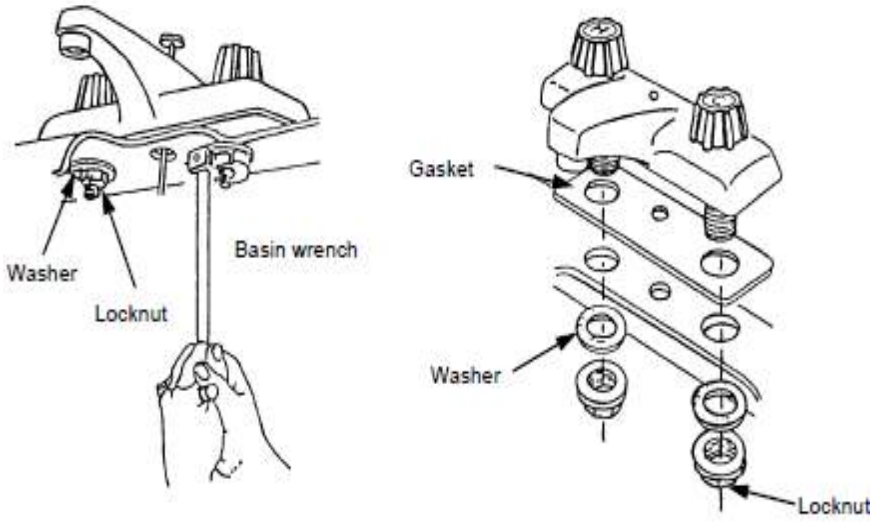
Step 1. Apply plumber's putty on the bottom of the faucet.

Step 2. Place the faucet on the top rear of the bowl, with the threaded end through the holes.

Step 3. Place a washer and attach a locknut to each threaded end under the bowl.

Step 4. Tighten each locknut with a basin wrench.

Step 5. Wipe off any excess putty, if used, around the faucet.



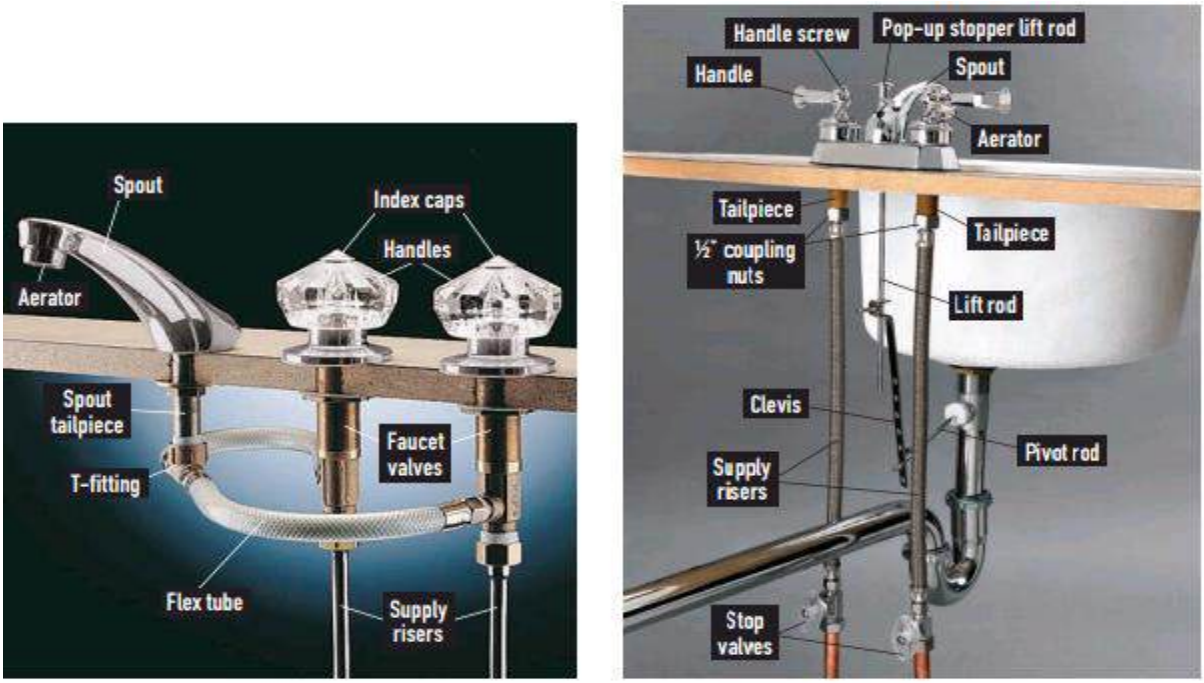


Figure 3.28 Lavatory faucets installation

Steps of flange installation for plug or a pop-up plug

Step 1. Apply a ring of plumber's putty around the drain outlet and set the flange firmly into the outlet.

Step 2. Connect the flange to the bowl with a washer and locknut.

Step 3. Coat the flange threads with pipe-joint compound and screw on the tailpiece.

Step 4. Connect the p-trap between the rough-in waste outlet and the tailpiece (Figure 3.29). All connections should be made with washers and slip nuts to form leak proof joints.

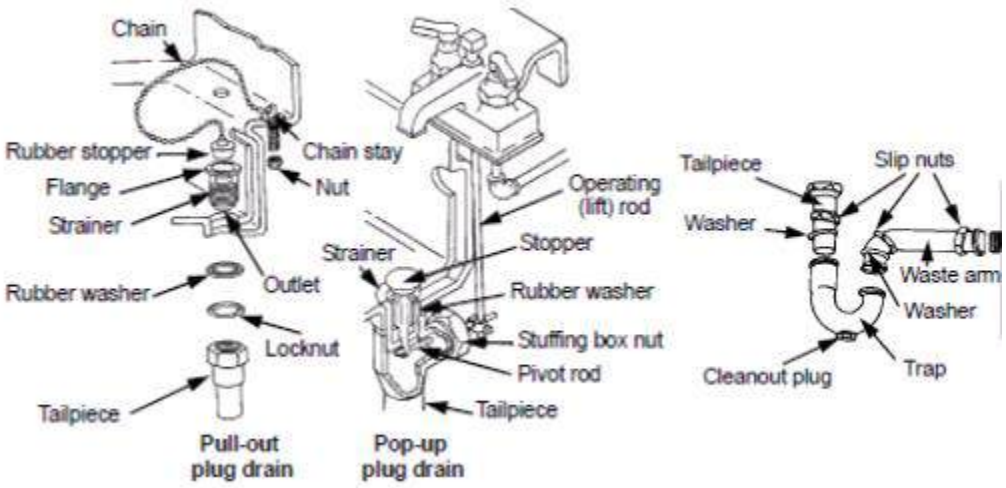


Figure 3.29 Drain-plug assembly and P-trap connection

Installing a pop-up drain

1. Put a basin under the trap to catch water.
2. Unscrew the cap holding the ball-and-pivot rod in the pop-up body and withdraw the ball.
3. Remove the pop-up stopper.
4. Clean the drain opening above and below, and then thread the locknut all the way down the new pop-up body, followed by the flat washer and the rubber gasket (beveled side up).
5. From below, face the pivot rod opening directly back toward the middle of the faucet and pull the body straight down to seat the flange.
6. Drop the pop-up stopper into the drain hole so the hole at the bottom of its post is closest to the back of the sink.
7. Put the cap behind the ball on the pivot rod as shown.
8. Loosen the clevis screw holding the clevis to the lift rod.

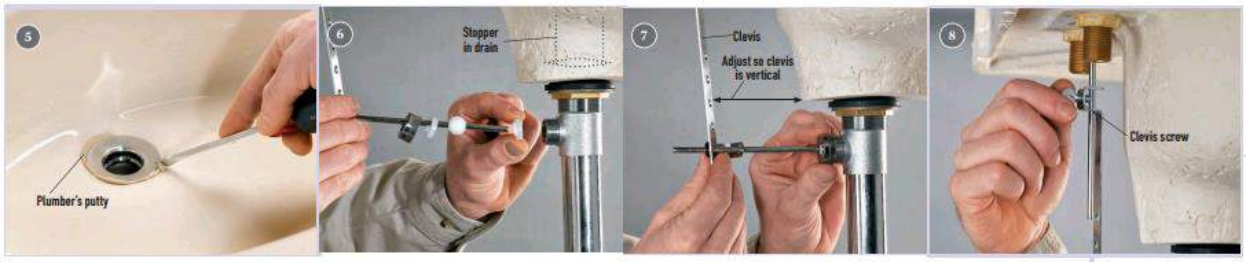


Figure 3.30 Installing a pop-up drain

Installing a widespread faucet

1. Insert the shank of the faucet spout through one of the holes in the sink deck (usually the center hole, but you can offset it in one of the end holes if you prefer).
2. In addition to mounting nuts, many spout valves for widespread faucets have an open-retainer fitting that goes between the underside of the deck and the mounting nut.
3. Mount the valves to the deck using whichever method the manufacturer specifies
4. From below, thread the mounting nuts that secure the valves to the sink deck.
5. Once you've started the nut on the threaded valve shank, secure the valve with a basin wrench, squeezing the lugs where the valve fits against the deck.
6. Attach the flexible supply tubes (supplied with the faucet) to the water outlets on the valves. Some twist onto the outlets, but others (like the ones above) click into place.
7. Attach flexible braided-metal supply risers to the water stop valves and then attach the tubes to the inlet port on each valve (usually with Teflon tape and a twist-on fitting at the valve end of the supply riser).
8. Attach the spout.
9. If your sink did not have a pop-up stopper, you'll need to replace the sink drain tailpiece with a pop-up stopper body (often supplied with the faucet).
10. Attach the clevis strap to the pivot rod that enters the pop-up drain body, and adjust the position of the strap so it raises and lowers properly when the lift rod is pulled up.
11. Attach the faucet handles to the valves using whichever method is required by the faucet manufacturer.
12. Turn on the water supply and test the faucet.

Figure 3.31 Installing a widespread faucet

Installing a single-body faucet

1. High-quality faucets come with flexible plastic gaskets that create a durable watertight seal at the bottom of the faucet, where it meets the sink deck.
2. Insert the faucet tailpieces through the holes in the sink.
3. Slide the lift rod of the new faucet into its hole behind the spout.
4. Grease the fluted valve stems with faucet grease then put the handles in place.
5. Unscrew the aerator from the end of the spout.

Figure 3.32 Installing a single-body faucet

Repairs of Pop-up plug

Use the repair steps below when the pop-up plug (stopper) fails to keep (Figure 3.33).

Step 1. Loosen the clevis screw with pliers.

Step 2. Push the pop-up plug (stopper) down so that it sits snugly on the flange.

Step 3. Tighten the clevis screw. Ensure that it fits snugly on the flange.

Step 4. Squeeze the spring clip and pull out the pivot rod from the clevis hole.

Step 5. Close the stopper and fill the bowl with water.

Step 6. Check the water level to ensure that the stopper holds water in the bowl. if steps 1-6 do not fix the problem, continue by using the following steps:

Step 7. Tighten the pivot-ball retaining nut. If the leak continues, remove the nut with pliers.

Step 8. Squeeze the spring clip, sliding the pivot rod out of the clevis hole.

Step 9. Slide the pivot-ball retaining nut and worn washers off the pivot rod.

Step 10. Slide new washers and the ball nut onto the pivot rod and tighten the pivot ball.

Step 11. Reassemble the pivot rod into the clevis hole.

Step 12. Run water into the lavatory and check the connection for leaks.

3.6.4 Clear up lavatory

Using Plunger

Use the procedures below to clear stoppages.

Step 1. Place a wet rag in the bowl's overflow opening. If the lavatory has a pop-up plug, remove the plug.

Step 2.Set a plunger over the waste outlet and push it up and down until the water completely drains out of the bowl.

Step 3.Remove the rag from the overflow opening and replace the pop-up plug, if necessary.

Step 4.Run water through the drain to ensure that the stoppage is removed.

Figure 3.33 Clear up lavatory using plunger

Using Snake

Use the steps below to clear stoppages.

Step 1.Remove the plug if the lavatory has a pop-up plug.

Step 2.Push the snake down into the waste outlet as far as it will go.

Step 3.Use a push-pull and turning action until the water completely drains out of the bowl.

Figure 3.34 Clear up lavatory using snake

Steps to clear lavatory stoppages of P-trap

Step 1.Place a container under the P-trap to catch the water spillage, and then disassemble the P-trap.

Step 2.Push the snake into the drain line, turning it with a push-pull action until it moves freely.

Step 3.Remove the snake and replace the P-trap, then run water through the drain line to ensure that the water flows freely.

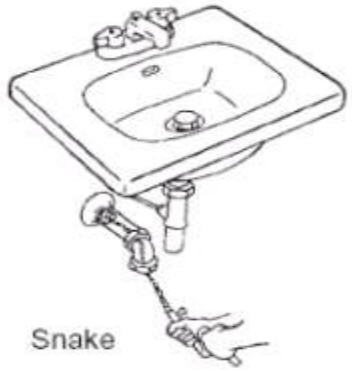


Figure 3.35 Clear up stoppages of P-trap

3.7 WATER CLOSET

Water Closet is a plumbing fixture used to convey organic body waste to the plumbing system. Water closet however, is classified according to design, shape, quality and color.

Based on design the water closet can be classified as pail flush type, siphon jet, squat type, siphon vortex, wash down type, direct flush valve type, and reverse type.

Based on the quality, with respect to quality, water closet must possess the following characteristics, flush down quietly, flush down the liquid and waste completely, must function efficiently, and must retain large amount of standing water surface area inside the bowl to prevent fouling and contamination.

Based on Shape, with respect to shape, water closet is classified into two types, namely; the Round Type, which is intended for installation on a limited space and the Elongated Type, which is more comfortable but occupies a larger space. More so, this type has a large amount of standing water inside the bowl which is more sanitary and easier to maintain.

Based on Color, with respect to color, various kinds of pastel and bright colors are now available for the designers and users freedom of choice.

3.7.1 Types of water closet

The Pail Flush Type Water Closet

The pail flush type water closet is the smallest and the simplest form of water closet designed without water tank. The flushing action can be agitated by a small quantity of water. It is a mini-water closet type intended for installation in a very limited space and budget.

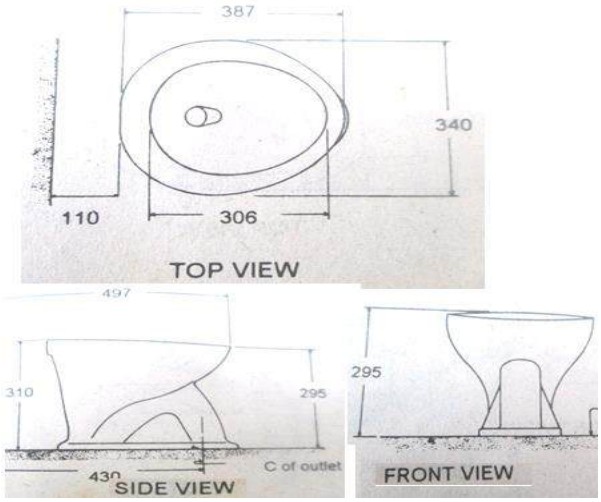


Figure 3.36 Dimensions of pail flush water closet

The Squat Type

The squat type is another simple type of water closet without water tank intended to be installed flat on the floor or elevated to a few centimeters from the floor line. Flushing action can be agitated with one half gallon of water similar with that of the pail flush type water closet. This type WC is commonly seen installed in a public toilet for ladies.

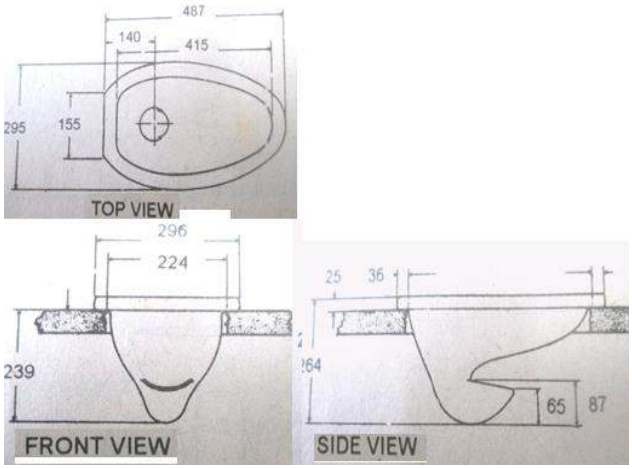
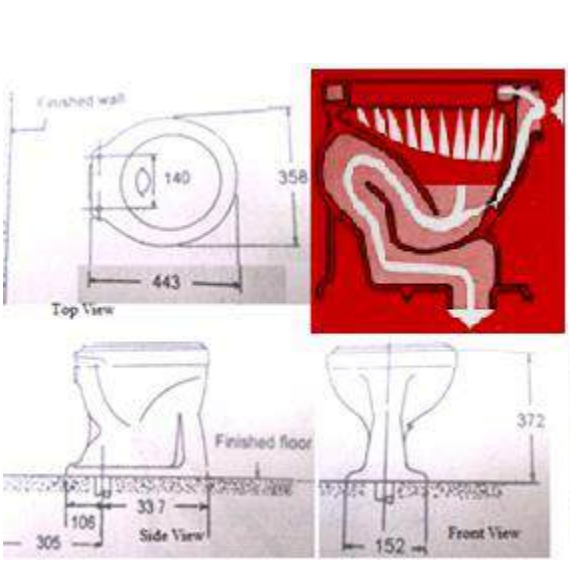


Figure 3.37 Squat Types WC

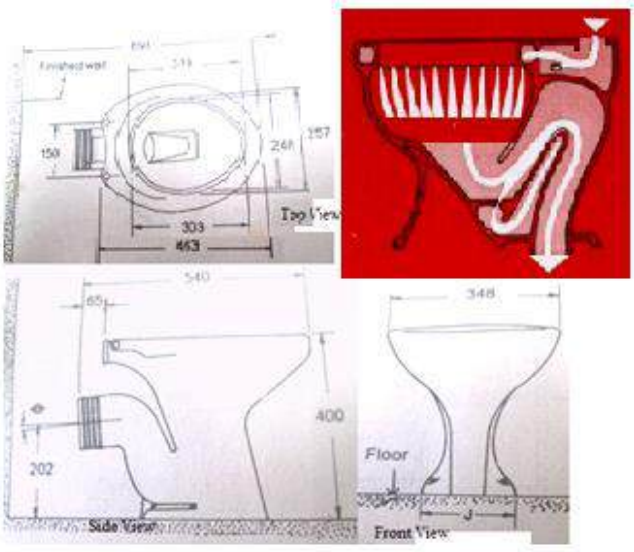
The Wash Down Type

The wash down type water closet has the following characteristics:

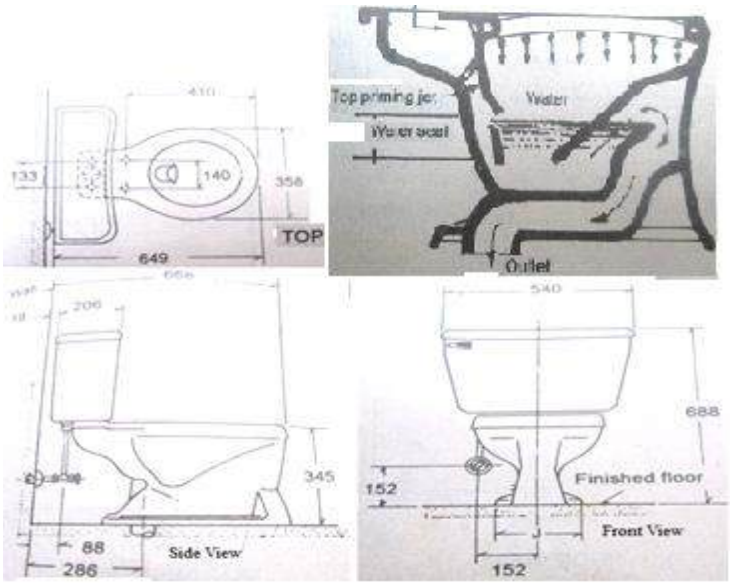
- It flushes through a simple wash down action.
- It discharges waste into a trap way located at the front of the bowl.
- It is easily recognized by the budget on the front.
- It is more subject to clogging than the other types.
- It has small amount of standing water leaving a large exposed surface at the inside front of the bowl which is susceptible to fouling, staining and contamination.
- It cost less but least efficient and the noisiest of all types of water closet.



(a) Siphon action washes down with jet



(b) Wash down toilet bowl



c) Wash down type water closet

Figure 3.38 Wash down type

The Reverse Trap

The reverse trap type water closet has the following characteristics:

- It flushes through a siphon action created in the trap way located at rear of the bowl.
- It retain large amount of surface water as compared with the wash down type,
- It is efficient but moderately noisy.
- This type of water closet is little more expensive than the wash down type.

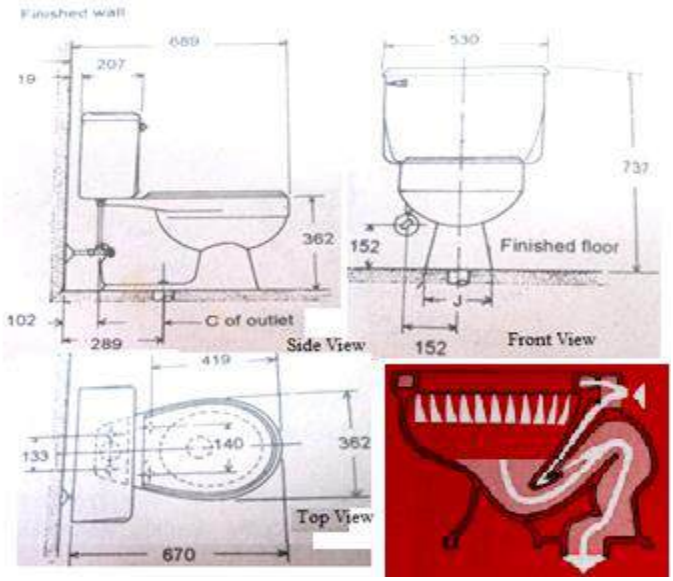


Figure 3.39 Reverse trap water closet

The Siphon Jet Water Closet

The siphon jet water closet has also the following characteristics:

- In terms of cost, it is higher than the wash down and the reverse trap type, but is more efficient in services.
- It retain larger amount of standing water which mostly cover the bowl interior.
- It has larger trap way making it less likely to clog and the flushing action is quieter than the other types.
- It is very sanitary than the other types.

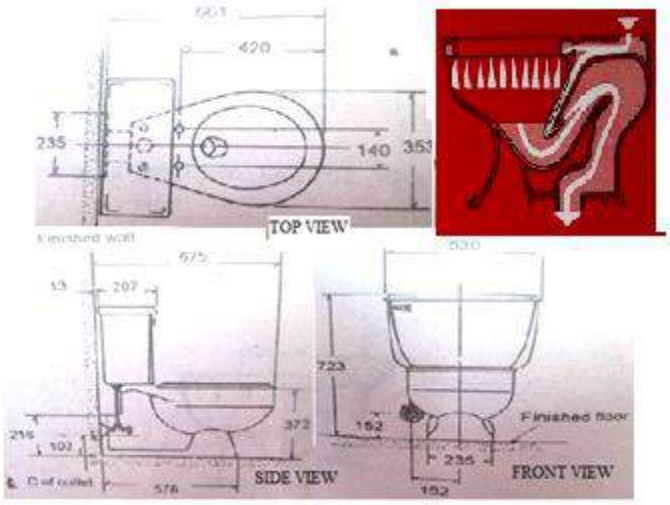


Figure 3.40 Siphon jet water closet

The Siphon Vortex Water Closet

This type of water closet has the following characteristics:

- Although it is acceptably expensive type of water closet bowl, yet proven to be less noisy and very efficient in service.
- The flushing action is started by a whirlpool motion followed by a flush down of the liquid and waste completely.
- It retain large amount of standing water covering almost the interior surface of the bowl.
- It is very sanitary and easy to clean.

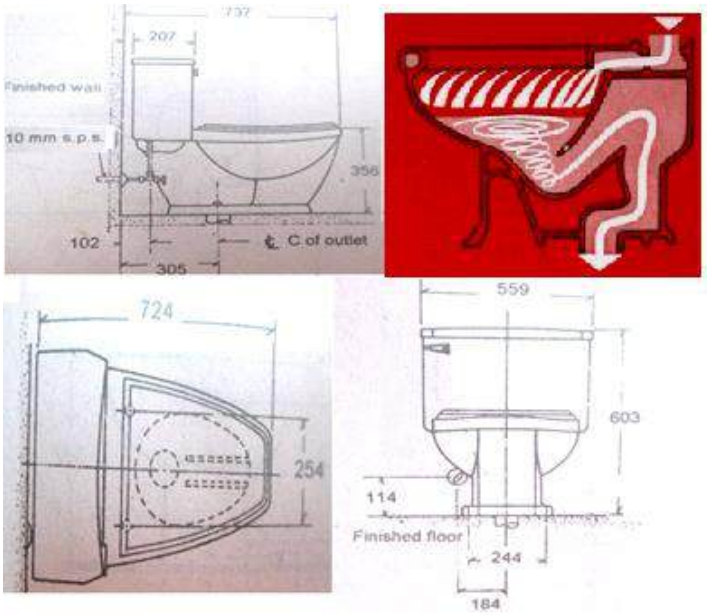


Figure 3.41 Siphon vortex water closets

The Direct Flush Valve Type Water Closet

This type of water closet is sometimes referred to as DFV. Most of the residential toilet consist of a bowl and a water tank which serve as a reservoir of water for flushing the toilet bowl. In places where water is abundant and the pressure is high, flushing action can be obtained directly from a flush valve accessories totally eliminate the installation of a toilet water tank. However, this particular type is commonly installed in commercial and institutional suite and sometimes on residential house at the choice of the owner.

3.7.2 Method of Closet Water Control

1. Gravity Tank WC

The water closets have 2- to 4-gal (7.5 to 15 L) water storage tanks. The water is discharged into the bowl by gravity.

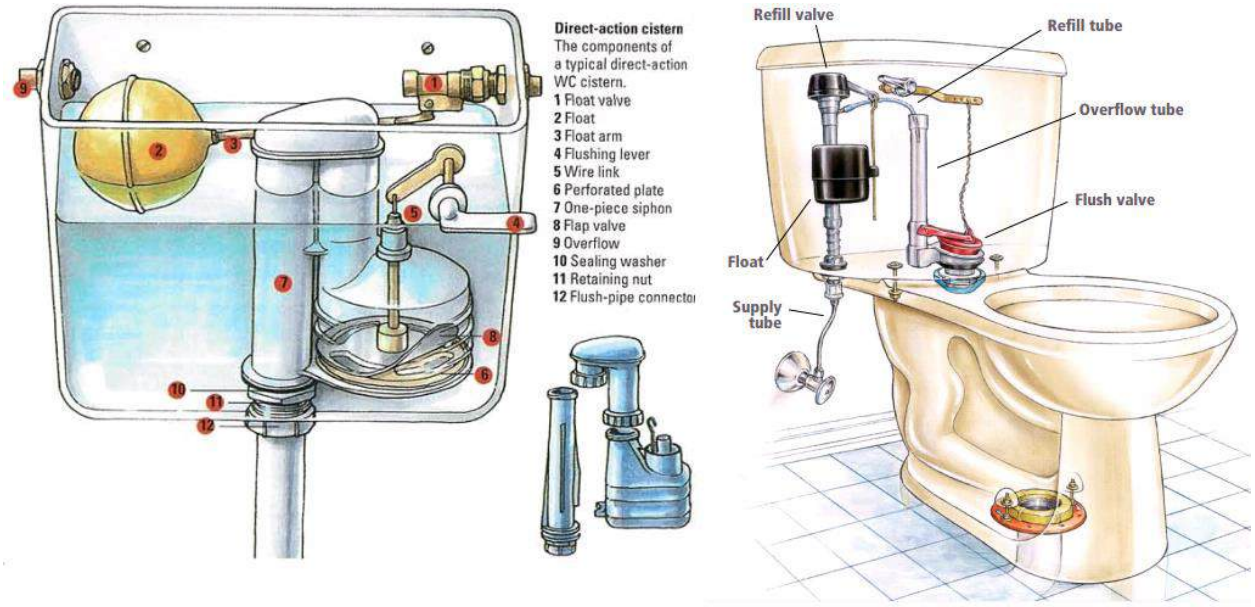


Figure 3.42 Detailed component of tank WC

2. Flush meter Valve WC

The water closets are equipped with a flush meter valve that admits a time-measured (adjustable between 5 and 10 seconds) amount of water into the bowl under the water pressure. The amount of water admitted is between 2 and 4 gal (7 to 15 L) which is similar to that of gravity tank type of control. However, the instantaneous water demand rate is considerably higher (about 20 to 30 GPM, 75 to 114 L/min). The flush meter type water closet can be ready for use immediately after flushing and therefore is mostly used in public applications.

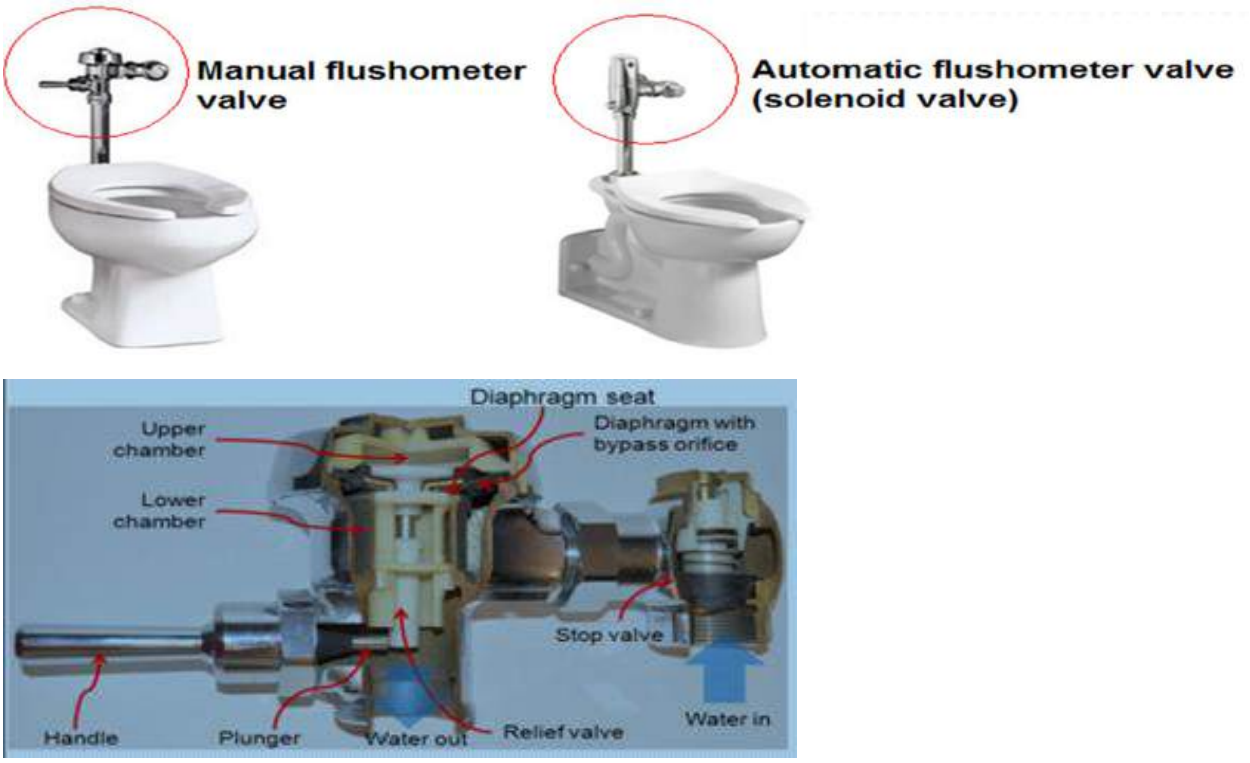


Figure 3.43 Components of flush meter valve

When the flush meter valve is in the closed position, the segment diaphragm divides the valve into an upper and lower chamber with equal water pressure on both sides of the diaphragm.

Movement of the handle in any direction pushes the plunger, which tilts the relief valve and allows water to escape from the upper chamber. Then, the water pressure in the lower chamber becomes greater than that of the upper chamber. This greater water pressure in the lower chamber raises the relief valve and the diaphragm as a unit and allows water flow through the valve. While the valve is operating, a small amount of water flows through the bypass orifice of the diaphragm, gradually refilling the upper chamber and equalizing the pressure once more. As the upper chamber fills, the diaphragm returns to the seat to close the valve.

3.7.3 Installation Related to Closet

Installation of Flush Valve

1. Before removing the old flush valve
2. Unscrew the bolts
3. Unhook the chain from the handle lever arm

4. Place the new flush valve in the valve hole
5. Position the flush valve flapper
6. With the tank lying on its back
7. With the hex nuts tightened against the tank bottom
8. Connect the chain clip to the handle lever arm

Figure 3.44 Installation of Flush Valve

Installation of Fill Valve

- Toilet fill valves wear out eventually. They can be repaired, but it's easier and a better fix to just replace them.
- If the fill valve spins while you turn the mounting nut, you may need to hold it still with locking pliers.
- The new fill valve must be installed so the critical level ("CL") mark is at least 1" above the overflow pipe (see inset).
- Adjust the height of the fill valve shank so the "CL" line and overflow pipe will be correctly related.
- Slip the valves threaded end down through the tank. Push down on its shank (not the top) while tightening the locknut (inset).

- If the overflow pipe has a cap, remove it. Attach one end of the refill tube from the new valve to the plastic angle adapter and the other end to the refill nipple near the top of the valve.
- Turn the water on fully. Slightly tighten any fitting that drips water. Adjust the water level in the tank by squeezing the spring clip on the float cup with needle nose pliers and moving the cup up or down on the link bar. Test the flush.

Figure 3.45 Installation of Fill Valve

3. Pressure tank WC

In the pressure tank type of control, the water closets are equipped with a pressurized tank within a conventional gravity tank. The pressurized tank is charged with air and water under 25 psi (172 kPa) water pressure. When the plunger at the base of the tank is released, the air-water mixture is forced into the bowl to blow out its contents. Because the blowout action is by pressure, 1.5 gal (5.7 L) of water is sufficient. Thus, a considerable amount of water is conserved. However, pressure tanks are noisy, which must be taken into consideration.

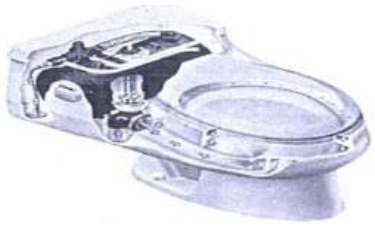


Figure 3.46 Pressure tank WC

4. Vacuum WC

The vacuum type of water closet operates on a central vacuum piping system. When the valve below the bowl is opened, the contents of the bowl are sucked into the drainage piping system under vacuum using only 0.3 gal (1 L) of water per flushing. This type of water closet is commonly used on airplanes, trains and oceangoing ships.

Figure 3.47 Vacuum WC

Water closets tank types

Tanks are classified as close-coupled (floor-mounted) and wall hung. A close-coupled tank is attached to a floor-mounted bowl. A wall-hung tank is attached to the wall above the bowl, using fittings for the bowl connection. The flushing mechanism is the same for both types.

Water closets tank installation

Steps to mount floor-mounted tank: use the following steps and as shown in Figure 3.48.

Step 1. Push the cone-shaped gasket over the tank's flush-valve outlet. Place the cushion gasket (if included) on the bowl and line up the holes.

Step 2. Place the tank on the bowl with the bolt holes lined up.

Step 3. Slide a rubber washer on each bolt, from inside the tank, push the bolts through the holes.

Step 4. Slide a washer over each bolt under the back lip of the bowl and hand tight the nuts.

Step 5. Tighten the nuts alternately to seat the cone gasket and tank on the bowl.

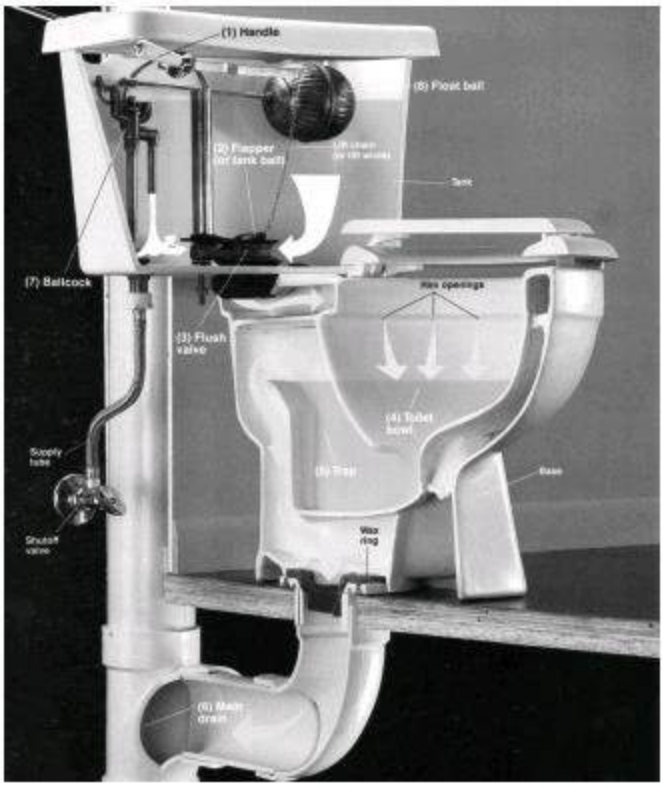


Figure 3.48 Detailed component of Floor-mounted tank

Wall Hung Tank

To mount a wall-hung tank, use the following steps,

Step 1. Install mounting board by notching the wall studs at recommended height.

Step 2. Install the elbow and spud connection (flange) to the rear of the bowl.

Step 3. Slide the slip nut, ring, and washer (in that order) onto the other end of the elbow.

Step 4. Attach the tank to the wall's mounting board with screw bolts. Make sure the elbow is in the tank's outlet and the tank is level.

Step 5. Check the elbow alignment and tighten the slip-joint nuts

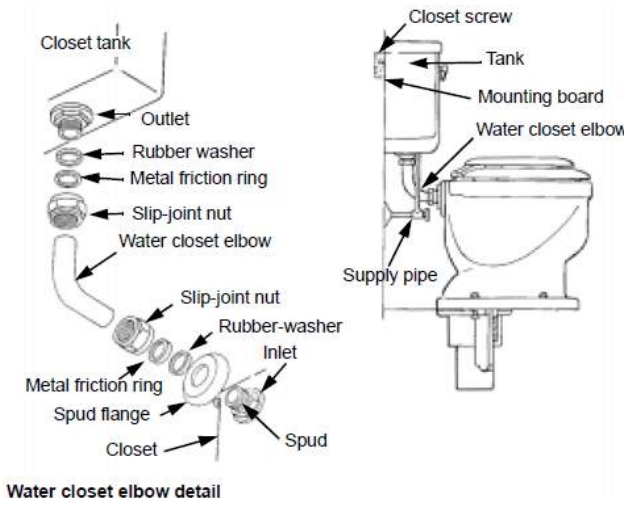


Figure 3.49 Wall-hung tanks

Water Closets Bowl Installation

Water-closet bowls are either floor-mounted or wall hung. The method of installing water closet bowls is the same regardless of the flushing action

Floor-mounted bowl:

The materials for floor-mounted water closet bowl install are a floor flange, a water closet bowl, a level, a wrench, and a wax or rubber gasket.

The steps of Floor-mounted bowl installation

Step 1. Place the floor flange over the closet bend until the flange rests on the finished floor and then make a joint for the type of piping being used.

Step 2. Put two bowl bolts with their threaded ends up into the flange slots.

Step 3. Turn the bowl upside down on protective waste newspaper or wooden strips to avoid scratching. Set a wax gasket over the horn.

Step 4. Turn the bowl right side up and set on the flange with the bolts through the holes of the bowl.

Step 5. Place a washer and nut on each bolt, tightening each alternately until the bowl is set.

Step 6. Ensure the bowl is in a level position. If not level, use thin metal shims to make it level.

Step 7. Place a nut cap on each nut and tighten down. Do not over tighten

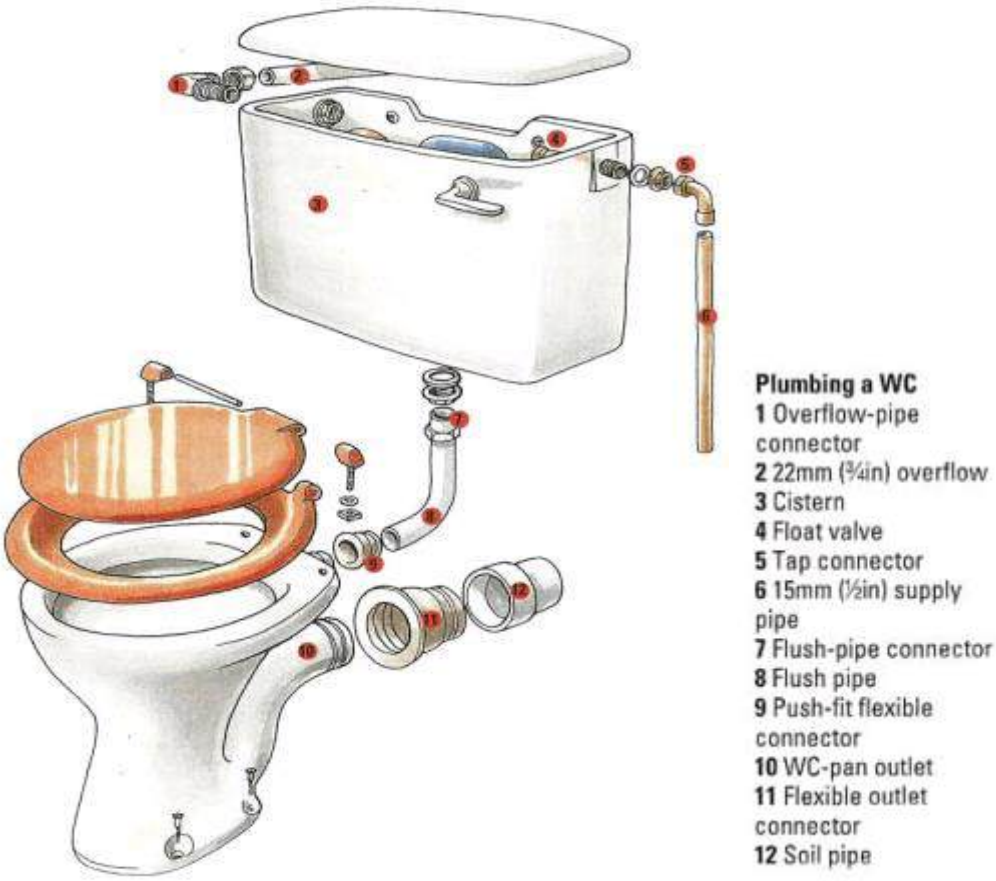


Figure 3.50 Detailed component of floor mount WC

Floor-mounted water closet bowl

1. Clean and inspect the closet flange.
2. Insert new tank bolts
3. Remove the wax ring
4. Lower the bowl onto the flange,
5. Attach the toilet tank.
6. Adjust the fill valve as directed
7. With the tank lying on its back,
8. Position the tank on the bowl,
9. You may stabilize the bolts
10. Hook up the water supply
11. Attach the toilet seat

Figure 3.51 Steps installation of floor-mounted water closet bowl

Wall hung bowl

A wall-hung, water closet bowl is installed on a carrier mounted between the wall studs. This type of water closet is used mainly in commercial buildings, but may also be found in residential buildings. Use the following steps and Figure 3.52 to hang a water closet bowl:

Step 1. Install a carrier using the manufacturer's instructions.

Step 2. Connect the carrier's outlet to the rough-in waste pipe.

Step 3. Place a sealing gasket in the rear opening of the bowl.

Step 4. Place the bowl against the wall with the carrier's bolts passing Through the bowl's holes.

Step 5. Place a washer and nut on each bolt.

Step 6. Keep the bowl level and tighten the nuts alternately.

Step 7. Place beauty caps over the bolts.

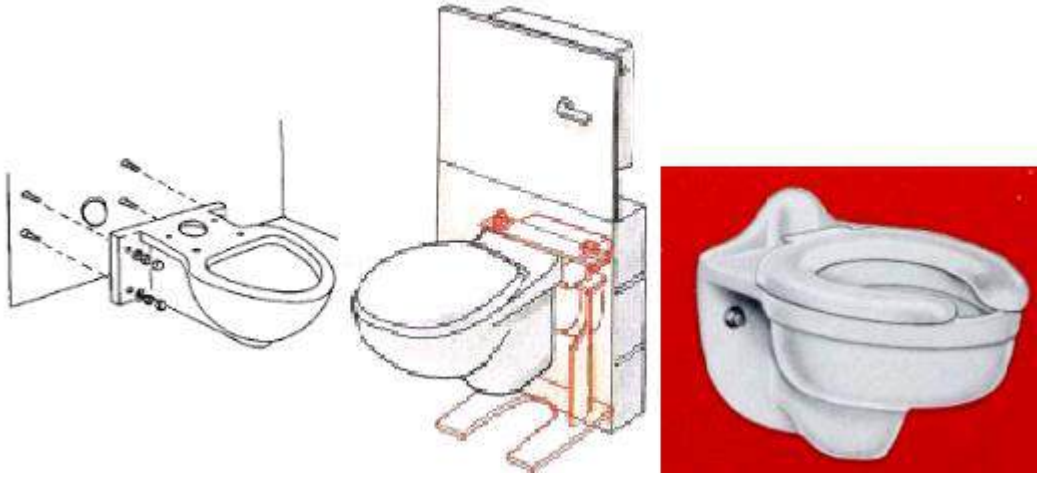


Figure 3.52 Wall hung bowl

3.7.4 REPAIRS AND MAINTENANCE

Flushometers

When the valve is not flushing or will not stop flushing, repair the flushometer as;

Diaphragm-type,

Step 1.Turn off the water supply and remove the outer cover.

Step 2.Remove the inner core. If the cover will not remove easily, pry it off with a screwdriver.

Step 3.Remove the relief valve.

Step 4.Remove the valve seat.

Step 5.Remove the clogged or worn diaphragm and clean.

Step 6.Install the new diaphragm.

Step 7.Reassemble the valve.

Step 8.Turn the water supply on and check the valve's operation.

Piston-type;

Step 1.Turn the water supply off and remove the outer cover and gasket.

Step 2.Remove the inner cover and the gasket.

Step 3.Remove the brass screws and retaining plate.

Step 4.Remove the clogged or worn rubber cup.

Step 5.Install the new rubber cup.

Step 6.Reassemble the valve.

Step 7.Turn the water supply on and check the valve's operation.

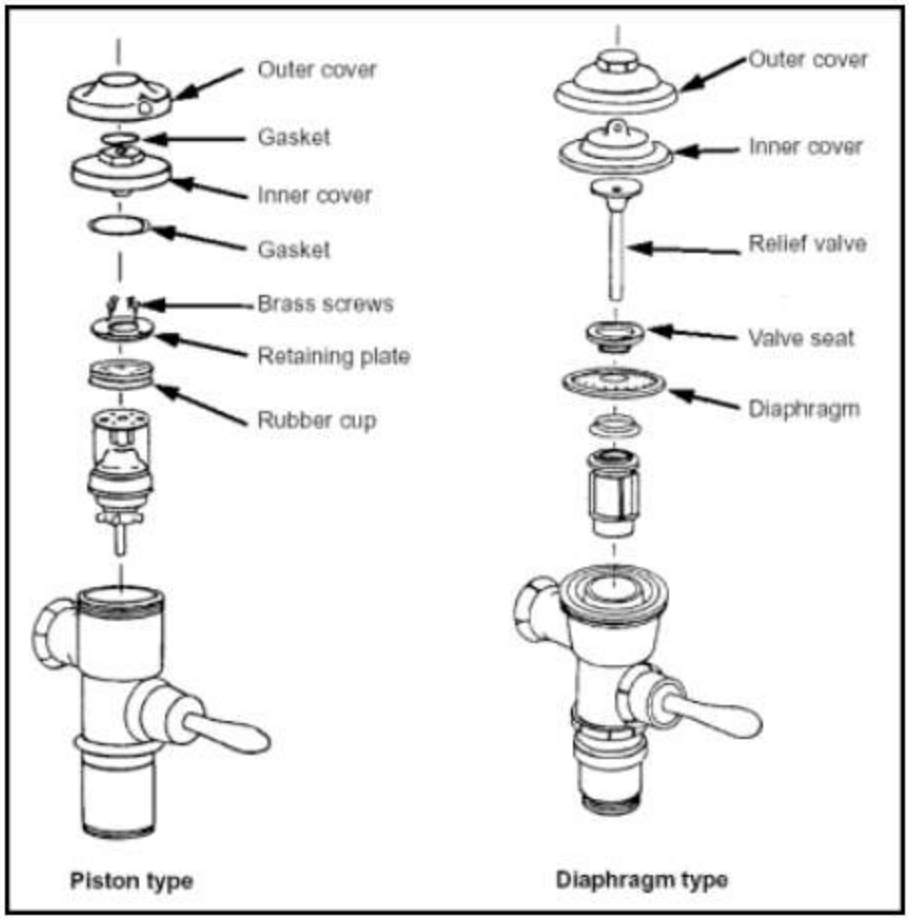


Figure 3.53 Components of flushometer

Flushometer Repairs

Use the steps to repair handles

Water leak at the handle,

Step 1.Turn the water supply off at the angle valve and unscrew the retaining nut.

Step 2.Pull out the handle body containing all the parts up to the packing nut.

Step 3.Grip the handle body with a wrench and unscrew the packing nut with another wrench.

Step 4.Remove the worn packing washer and install the new packing washer.

Step 5.Reassemble all the parts.

Step 6.Turn the water supply on and check the handle for leaks and for proper operation.

Loose or wobbly handle

Step 1.Turn the water supply off at the angle valve and unscrew the retaining nut.

Step 2.Pull out the handle body containing all the parts up to the packing nut.

Step 3.Grip the handle body with a wrench and unscrew the packing nut with another wrench.

Step 4.Grip the handle body with a wrench and unscrew the bushing with lock-grip pliers.

Step 5.Remove the worn bushing spring or plunger and replace worn parts with new ones.

Step 6.Reassemble all the parts.

Step 7.Turn the water supply on and check the handle for leaks and for proper operation.

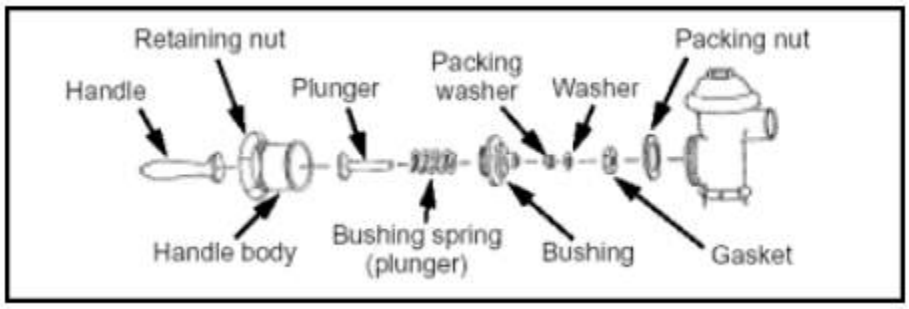


Figure 3.54 Flushometer Handle Repair

Steps to Repair Ball-Cock

The water level is so high that it is running into the top of the overflow pipe.

Step 1.Remove the tank top and unscrew the float ball from the float rod.

Step 2.Shake the float ball to find out if water is in the ball. If water is inside the ball, replace the ball. If no water is in the ball, the float ball is functional.

Step 3.Screw the float ball back onto the rod.

Step 4.Place both hands on the middle of the float rod and carefully bend the ball side of the rod down about 1/2 inch.

Step 5.Flush the water closet to see that the water level is about one inch below the top of the overflow pipe and then replace the tank top.

Steps to Repair the water running in a water closet

Step 1.Remove the tank top and turn off the water supply at the shutoff valve.

Step 2.Flush the water closet to empty the tank.

Step 3.Unscrew the flush (tank) ball from the lift wire.

Step 4.Check the bottom of the flush ball for damage or wear.

Step 5.If the flush ball is damaged or worn, replace it with a new one.

Step 6.Clean the flush outlet valve seat with emery cloth or steel wool.

Step 7.Operate the handle to see that the flush ball sits evenly in the flush-outlet valve.

Step 8.Turn the water supply on and flush the water closet to check the repair.

Or

- Remove the old supply tube.
- Grip each tank bolt nut
- Remove the nuts that hold the bowl to the floor.
- Removing an old wax ring

Figure 3.55 Steps to Repair water closet

Replace the tank top

Step 1.Remove the tank top and turn the water supply off.

Step 2.Flush the water closet to empty the tank.

Step 3.Remove the float rod with the float ball attached.

Step 4.Remove the screws or pins at the top of the ball cock assembly.

Step 5.Lift the plunger out of the assembly.

Step 6.Remove the washer located under the bottom of the plunger and O-ring from around the plunger and replace them.

Step 7.Reassemble the ball cock assembly float rod with a float ball attached.

Step 8.Turn the water supply on and check the ball cock.

Float-Cup Repairs

Use the following steps to make repairs to the float cup

The water level is so high that it is running into the overflow pipe.

Step 1.Remove the tank top. Squeeze the top and bottom of the adjustment clip and move it down on the pull rod to lower the float cup.

Step 2.Flush the tank and then check the incoming water level.

Step 3.Replace the tank top if the level is correct.

Step 4.Replace the tank top.

Repairing Waste System Stoppages

The common problem in waste systems is a stoppage. A stoppage can occur in a fixture drain, floor drain, branch line, or main line. The cause can be hair, grease, or other foreign matter that holds back the flow of waste disposal. Use the proper clearing tool to clear the stoppage. These tools below are designed to clear stoppages in different areas of the waste system. These areas include water closets, lavatories and sinks, urinals, bathtubs, shower drains, branch and main waste lines, and grease traps.

Figure 3.56 Clearing Tools

Water closet stoppages can be cleared with

Force-cup plunger

Use the following steps to clear stoppages with a force-cup plunger:

Step 1.Pump the plunger up and down until the water level drops.

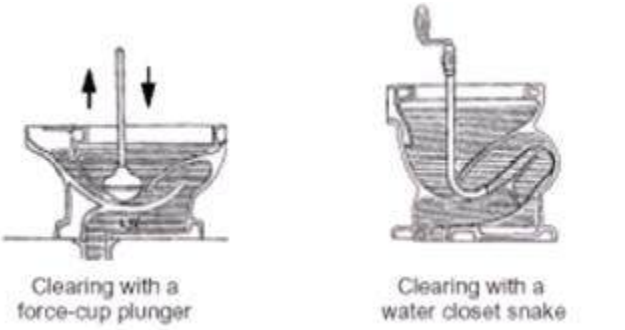
Step 2.Place toilet paper in the bowl and flush the water closet to check if the stoppage is cleared.

Water closet snake

Use the following steps to clear stoppages with a water closet snake:

Step 1.Push the snake into the bowl and turn the handle clockwise with a push-pull action until the water level drops.

Step 2.Check to see if the stoppage is cleared as in step 2 above.



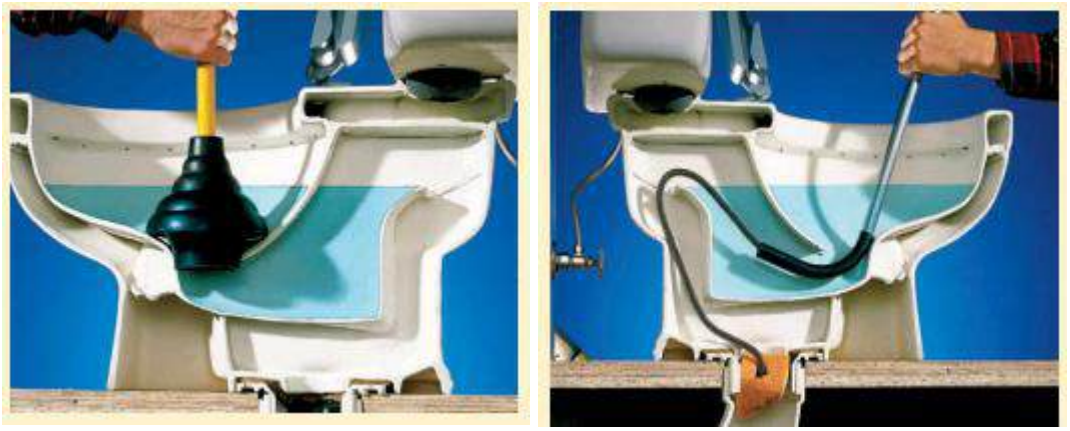


Figure 3.57 cleaning water closet

3.8 URINALS

Since urinals are commonly installed in public rest rooms and are subjected to hard usage, it is essential that they posse's features which enable them to be kept as clean and free of debris as possible. Frequently, the toilet is used (rather than the urinal), which may be an entirely sanitary practice; however, the toilet is too low for convenient use as a urinal. Similar to water closets in construction and operating principle, they are either wall mounted or floor-mounted. Water flushing action should thoroughly clean the entire interior fixture surface. Urinal should be

constructed from a material that is nonabsorbent and no corrosive. Wood should never be used, because it is absorbent and iron is corrosive. The two materials that are best suit for this purpose are earthenware and vitreous china.

3.8.1 Types of urinal

There are different types of urinals are in use. These are known as trough, individual wall type, pedestal and stall.

Trough

The trough type urinal is provided with a polished brass beehive-type strainer and a concealed perforated brass flush pipe. It is wall hung with a flush tank. The urinal has perforated pipe across the rear, which allows water to flow down the back of the trough when flushed.

Typical roughing-in dimensions may vary and should for a trough-type urinal.

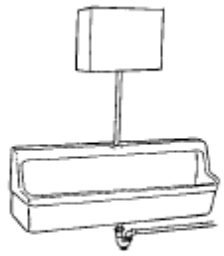


Figure 3.58 Trough

Individual wall-type

Several different types of individual wall-type urinals are used. The wall type unit usually consists of a bowl that is attached to the wall at a convenient height and means for flushing and discharging the waste. The two common methods of flushing used are: the wash down type and the siphon-jet type. The lip-type urinals should be of the flushing rim type. This permits thorough cleansing of the entire interior surface of each flushing. Since the bowl of the wash down type of urinal does not carry a standing body of water, an offensive odor may result, unless the urinal is flushed each time that it is used. This is not a disadvantage in the siphon –jet type of urinal, because a quantity of water remains in the bowl after each flushing.

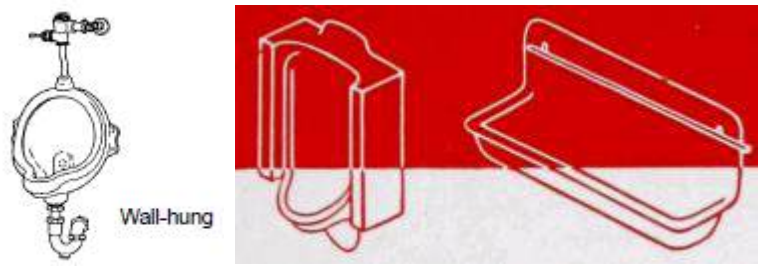


Figure 3.59 Wall hung

Pedestal- type

The basic construction of the pedestal-type urinal is similar to the toilet bowl. Since it is flushed and cleaned by siphon-jet action. It is probably the most sanitary of all the different types of urinals, because all waste material is removed with each flushing action. The passage through the trap is just as large as that most toilets, and because of the siphon jet action, clogging is almost impossible.

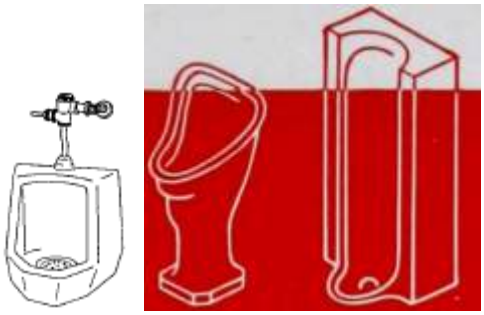


Figure 3.60 Pedestal

Stall-type

These are usually designed with careful consideration of the hygienic principles that are essential to good health. The sloped front design encourages closer approaches over the lip of the urinal; consequently, improvement in rest-room cleanliness and easier maintenance result. The drip receptor is unusual large, and the sides are straight, facilitating tile setting. These urinals are available with integral flushing rims, which distribute the flushing action evenly to cleanse the stall interiors thoroughly.

3.8.2 Urinals Installation

Steps to Install Wall-hung Urinal:

Wall hung: use the following steps to hang

1. Install the drainpipe and vent pipe,

2. Attach the mounting brackets above the floor,
3. Apply Teflon tape to the waste outlet
4. Hang the urinal on the brackets
5. Determine the distance from the centerline of the water inlet on the top of the urinal,
6. Measure from the wall surface to the first thread of the adapter.
7. Apply a small amount of pipe sealant to the adapter threads, and then thread the control stop onto the adapter threads.
8. Hand tightens the tailpiece into the flushometer valve body.
9. Hand tightens the slip nut that connects the valve body to the control stop.
10. Use a smooth-jawed spud wrench to securely tighten the tailpiece, vacuum breaker, and spud couplings.
11. Test, while testing the flush, adjust the supply stop screw counter-clockwise until adequate flow is achieved.

Figure 3.61 Steps to Install Wall-hung Urinal

Steps to Install Trough

Use the following steps to hang a trough urinal

Step 1. Install the mounting board for the trough and tank.

Step 2. Attach the tank to the wall and install the flushing mechanism.

Step 3. Install the hanger for the trough bowl.

Step 4. Attach the bowl to the wall.

Step 5. Install the waste connection to the rough-in piping.

Step 6. Install the piping from the tank to the trough bowl.

Step 7. Install a water line between the tank and the rough-in piping.

Step 8. Turn on the main water supply and flush the urinal several times to Check for leaks.

3.9 Showers

The showering is generally quicker than taking a bath, this helps to alleviate the morning queue for the bathroom. Shower add value to your home. Improvements in technology have made available a variety of powerful and controllable showers. Showers can be integrated with a bathtub or be independently constructed into shower stalls or a group of showers. One major concern is the control of water temperature by a mixing valve between cold and hot water. A

shower has many advantages over a bathtub which include the small amount of space required for installation, the small amount of water used compared with bathtub use, and sanitation.

Types of Pressure and flow of water in shower

When choosing a shower, it should be considered in mind that pressure and flow are not the same thing.

Gravity fed showers

In many homes cold water is stored in a tank, from which it is fed to a hot water cylinder situated at a lower level. Both the hot and cold water pressures are determined by the height (head) of this cold water storage tank above the shower. Provided there is at least on 3ft between the bottom of the tank and the showerhead to have reasonable flow rate and pressure. If flow and pressure are insufficient for a satisfactory shower, it may be possible to improve the situation either by raising the tank or by installing a pump in the system.

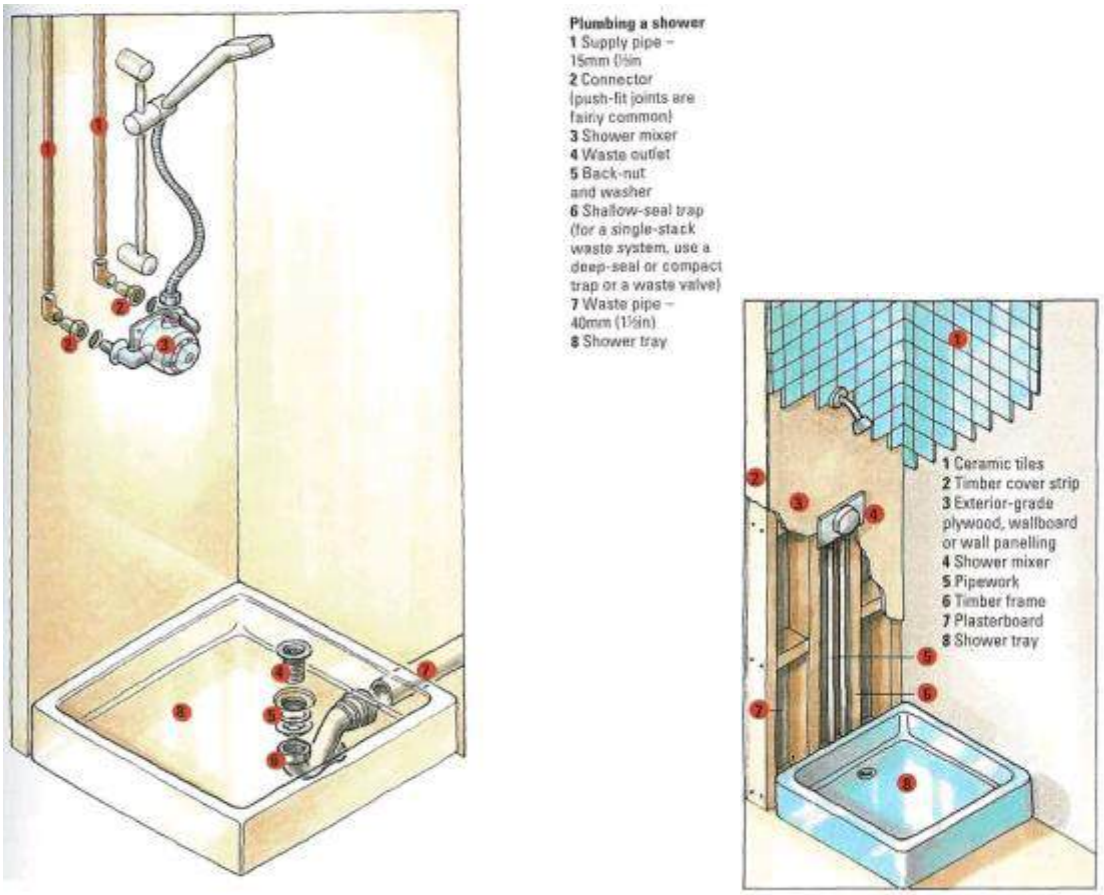


Figure 3.62 Detailed shower components

Electric Shower

If you've decided to install an instantaneous shower in the cubicle, run both the electrical supply cable and a single 15mm pipe from the rising main through the stud partition. Fit a non-return valve and an isolating valve in the pipe. Drill two holes in the wall just behind the shower unit for the pipe and cable. Join a threaded or compression connector to the supply pipe, whichever is appropriate for the water inlet built into the shower unit.

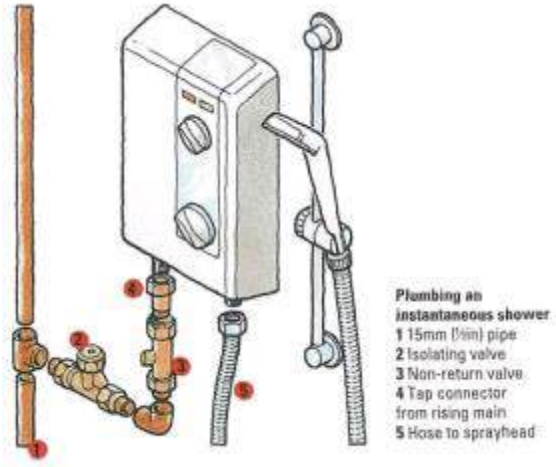


Figure 3.63 Detailed of electrical shower components

Main pressure showers

You can supply some types of shower directly from the mains. In fact, one of the simplest to install is an instantaneous electric shower, which is designed for use with mains pressure. Another alternative is to install a thermal-store cylinder. Mains-pressure water passes through a rapid heat exchanger inside the cylinder. Yet another option is to store hot water in an unvented cylinder, which will supply high-pressure water to a shower without the need for a booster pump. Nowadays showers are often supplied from combination boilers, though these often need to run at full flow to keep the boiler firing properly before buying a shower.

Shower pumps

Pumped or boosted showers are used to overcome the problems of restricted head. The shower pumps is suitable for boosting an individual mixer shower or supplying a tank-fed instantaneous electric shower, by increasing the static pressure and flow rate to the shower outlet. They are not designed for use on mains-fed installations. They can be used on installations with as little as 300

mm head. Manufacturers provide detailed installation instructions, including the electrical connection requirements, and these should be strictly followed.

3.9.1 Shower heads

If spray from the showerhead is uneven, clean the spray holes. The outlet or inlet holes of the showerhead may get clogged with mineral deposits. Showerheads pivot into different positions.

Figure 3.64 shower head

3.9.2 Shower Installations

Tile shower installation

The tile shower has tile or marble walls on three sides with a waterproof shower curtain or door that can be closed while the shower is in use. The tiled floor slopes to the center (or rear) where a drain is placed. The wall should be waterproofed by setting the tile in waterproof cement. The floor is generally laid upon a lead shower pan, which forms a waterproof base on which to lay the tile, as shown in Figure 3.65. Complete waterproofing is the most important requirement of shower installation. Tile installed with good-quality waterproof cement provides a waterproofed wall. For the floor, a waterproof base (shower pan) under the shower is necessary, since water standing on the tile surface can seep through and cause leaks.

Lead shower pan

Before installing the lead shower pan, a carpenter must rough in the general outline of the stall and lay a solid base of subflooring or plywood. Without a solid base, the shower pan is soft and

flexible. If not supported properly, the pan will sag and leak under the weight of the tile. Inspect the rough in of the trap underneath the flooring to ensure that the outlet is correctly placed.

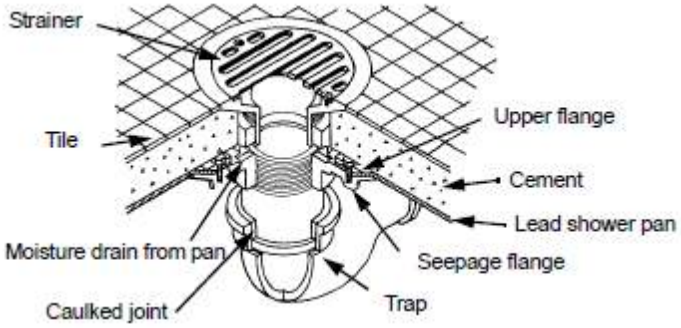


Figure 3.65 Shower pan installation

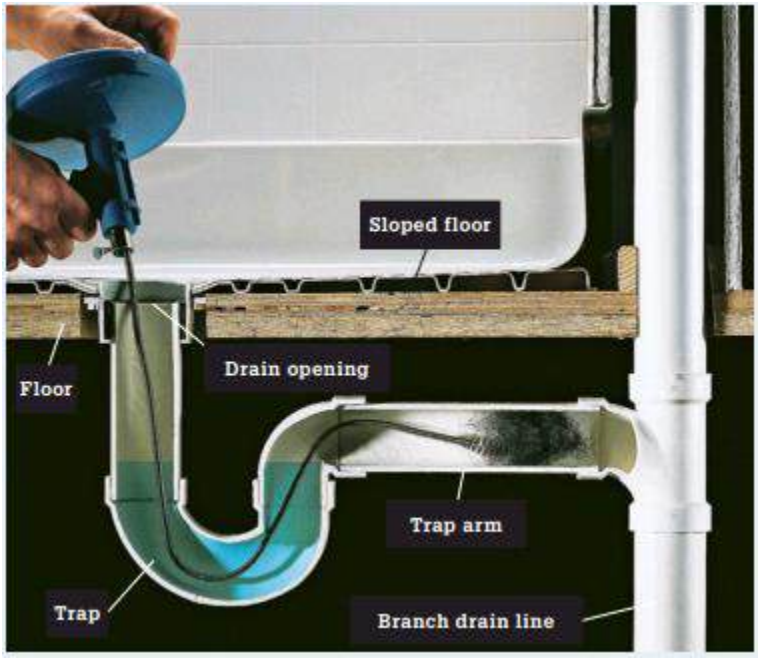


Figure 3.66 Clearing of Shower pan installation

Many types of shower drains are available. The one in Figure 3.67, has the proper-length nipple for placing the seepage flange at a level with the lead pan threaded into the nipple. The lead pan is made by using a solid sheet of lead 6 to 8 inches larger than the size of the shower floor and bending up the edges at right angles to the desired height. Use the following procedure to install a lead shower pan:

Step 1. Cut a hole where the drain is located and lower the lead shower pan into place. The pan should rest firmly on the seepage flange of the shower drain.

Step 2. Coat the inside of the lead shower pan with asphalt.

Step 3. Place pipe-joint compound or putty under the top of the flange.

Step 4. Place the upper flange on top of the lower flange and attach them together to form a watertight joint between the shower waste and the shower pan.

Step 5. Thread the strainer down into the flanges to the desired level of the tile.

Step 6. Complete the installation by laying cement in the shower pan and tiling the floor.

Concrete shower pan

Concrete shower pans with prefabricated, steel shower stalls are easy to install. They are often set up after the original construction. In this case, the cement base is laid directly on top of the floor.

Stall shower installation:

The stall shower is a prefabricated unit with three sides and a base, fitted together. The sides are thin sheets of grooved steel, fitted together with a watertight joint. The base is usually precast concrete. Spray from the showerhead causes considerable noise as it hits the thin steel, and the metal sides tend to rust rapidly.

Fixing and Replacing Showerheads

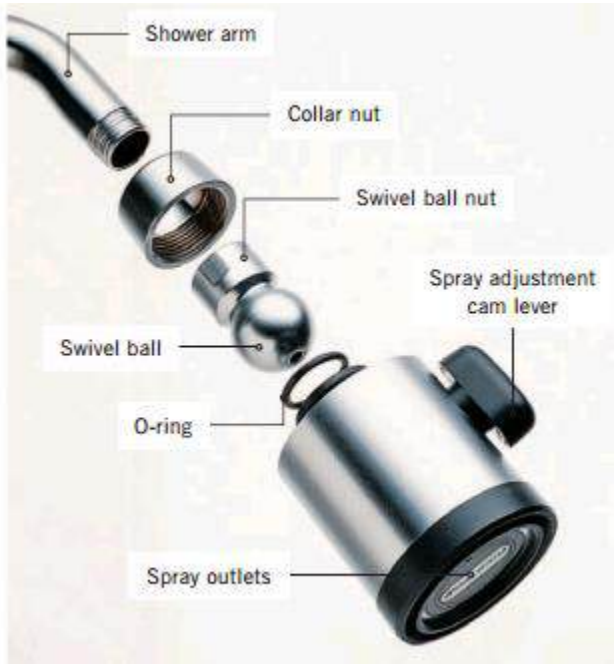


Figure 3.68 Shower head detailed

- Unscrew the swivel ball nut, using an adjustable wrench or channel-type pliers. Wrap jaws of the tool with masking tape to prevent marring the finish. Unscrew collar nut from the showerhead
- Clean outlet and inlet holes of showerhead with a thin wire. Flush the head with clean water.
- Replace the O-ring, if necessary. Lubricate the O-ring with heatproof grease before installing.

Figure 3.69 Repairing of shower head

3.9.3 Repair and Fixing Tub and Shower Faucets

Compression Diverter Valve of A three-handle tub/shower faucet

- Remove the diverter valve handle with a screwdriver.
- Remove bonnet nut with an adjustable wrench or channel-type pliers.
- Unscrew the stem assembly, using a deep-set ratchet wrench.
- Remove brass stem screw.
- Unscrew the stem assembly, using a deep-set ratchet wrench.
- Unscrew the threaded spindle from the retaining nut.
- Clean sediment and lime buildup from nut, using a small wire brush dipped in vinegar.

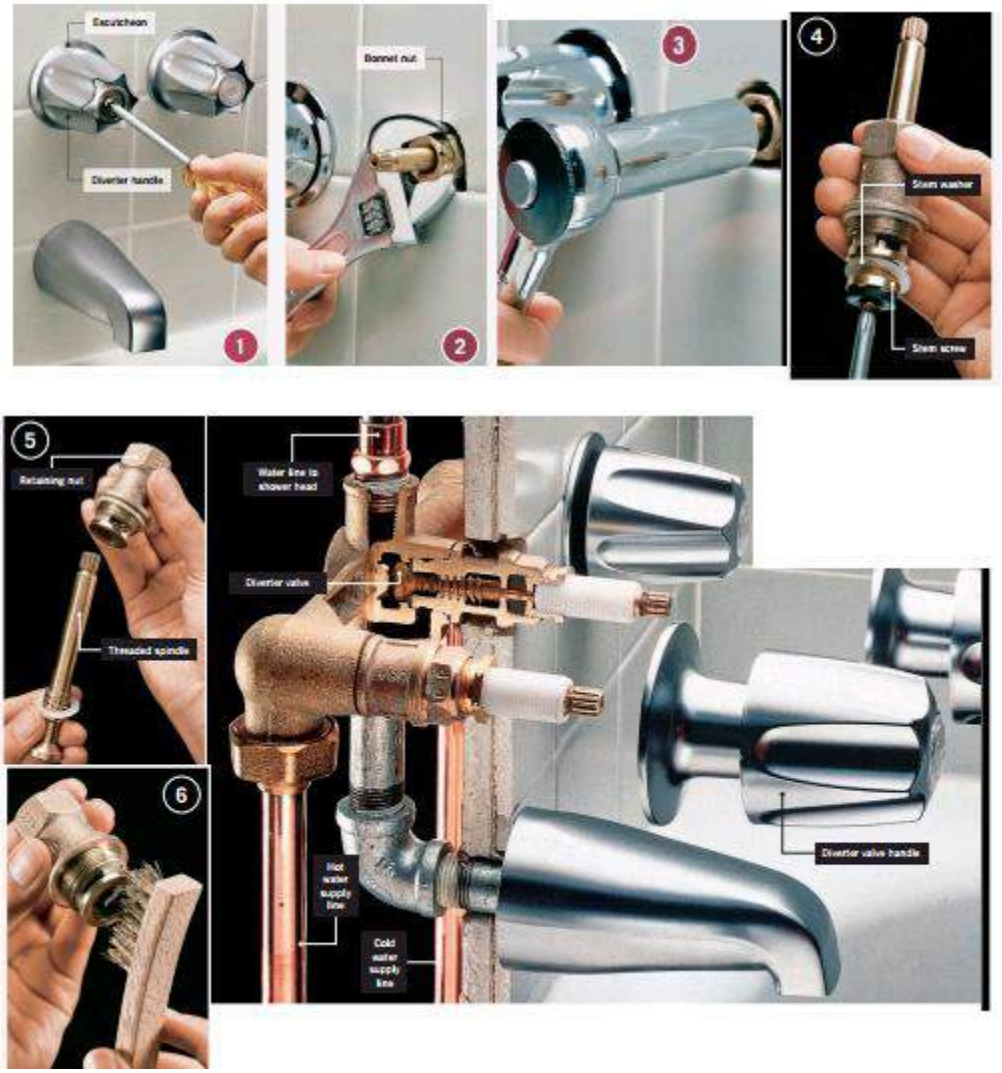


Figure 3.70 Fixing Three-Handle Tub and Shower Faucets

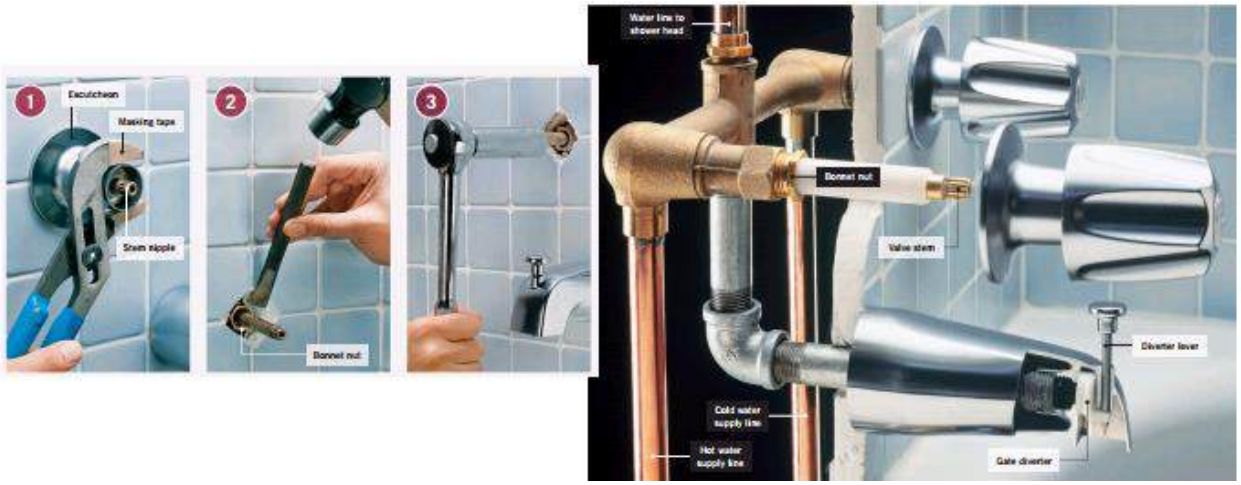


Figure 3.71 Fixing Two-Handle Tub & Shower Faucets

Figure 3.72 Fixing Single-Handle Tub & Shower Faucets

Repair a Single-handle Cartridge Tub and Shower Faucet

1. Use a screwdriver to remove the handle and escutcheon
2. Turn off water supply at the built-in shutoff valves or the main shutoff valve.
3. Unscrew and remove the retaining ring or bonnet nut, using adjustable wrench
4. Remove the cartridge assembly by grasping the end of the valve with channel-type pliers and pulling gently
5. Flush the valve body with clean water to remove sediment

Figure 3.73 Repair a Single-handle Cartridge Tub and Shower Faucet

3.9.4 Cleaning Shower Drains

Shower drains can be cleared by using

Hose

Use the steps below to clear drains (hose).

Step 1.Remove the strainer from the drain.

Step 2.Hook up the water hose to a source of water and place the other end of the hose into the drain.

Step 3.Stuff rags around the hose to form a tight seal.

Step 4.Turn the water on full force, then off and on again.

Step 5.Replace the strainer.

Snake

Use the steps below to clear drains.

Step 1.Remove the strainer from the drain.

Step 2.Push the snake into the drain and turn the snake with a push-pull action until it moves freely.

Step 3.Remove the snake and replace the strainer

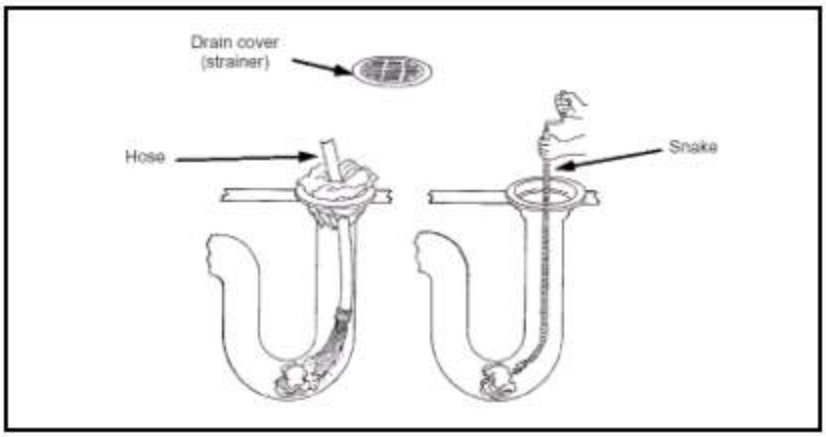


Figure 3.74 Clean and Repair a Shower Head

Shower drainage

Shower drain clogs usually are caused by an accumulation of hair in the drain line .Remove the strainer cover and look for clogs in the drain opening. Some clogs are removed easily with apiece of stiff wire. Stubborn clogs should be removed with a plunger or hand auger.

Clear a Shower Drain

Check for clogs.

Remove strainer cover, using a screw driver. Use a flash light to look for hair clogs in the drain opening. Use a stiff wire to clear shower drain of hair or to snag any obstructions.

Use a plunger to clear most shower drain clogs. Place the rubber cup over the drain opening. Pour enough water in to the shower stall to cover the lip of the cup. Move plunger handles up and down rapidly

Clear stubborn clog sin the shower drain with a hand auger. Use the auger as shown below.

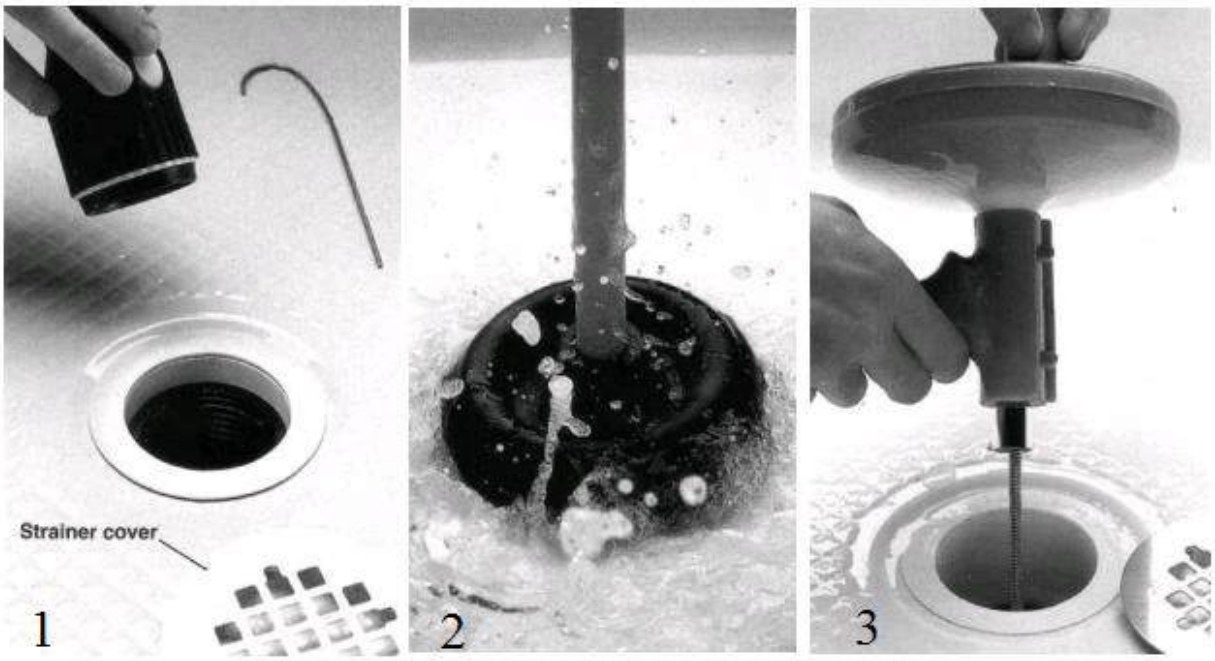


Figure 3.75 Clear a Shower Drain

3.10 Sinks

Sinks are available for different uses and come in several sizes and shapes. They are made of enameled cast iron, enameled pressed-steel, galvanized-steel, and stainless-steel.

3.10.1 Types of Sink

Scullery sinks: they are large, deep sinks used in mess-hall-type facilities. Scullery sinks need only installation of faucets and connection to waste and water supply lines. Scullery sinks are used for general kitchen.

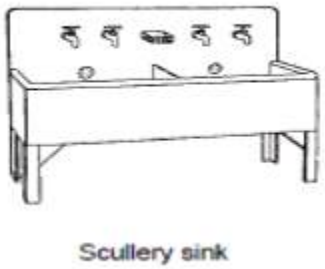


Figure 3.76 Scullery sinks

Slop sink: these sinks are used for bucket and mop. The two styles of slop (utility) sinks are trap to floor (stand trap) and trap to wall. Each is used for disposing of wash water, filling mop buckets, and washing out mops.

Slop sink

Figure 3.77 Slop sink

Kitchen sinks: they can be either single-or double-compartment and can be wall hung or set in a counter top. Kitchen sinks have a strainer to prevent food waste from entering the waste system. The waste pipe must be short and as free from offset as possible. Kitchen sink are stainless steel particular model is a right-hand drainer, with a single hole for use with a monoblack tap.

Kitchen sink can be of any of the following configurations:

1. Single, double or triple well
2. Shallow or deep well

Typical sink design and waste fitting

(a) (b)

Gloucester sink (Reproduced with permission of Ideal Standard Armitage Shanks)

Figure 3.78 Kitchen sink

Belfast sinks

Originally, Belfast sinks, were used in older properties, as well as in applications, such as schools and residential accommodation. The hot and cold water was usually supplied by pair of bib taps, and were ideal for filling and emptying mop buckets, and washing out or cleaning utensils. They are designed to take slotted waste, which takes away any water that finds its way through the overflow.

Figure 3.79 Belfast sinks

Vanity Top

Most bathroom countertops installed today are integral (one-piece) sink-countertop units made from cultured marble or other solid materials, like solid surfacing. Integral sink-countertops are convenient, and many are inexpensive, but style and color options are limited. Some remodelers and designers still prefer the distinctive look of a custom-built countertop with a self-rimming sink basin, which gives you a much greater selection of styles and colors. Installing a self-rimming sink is very simple.

Figure 3.80 Vanity Top

3.10.2 Installation of kitchen sink

Installing a kitchen sink is much the same as fitting a washbasin or vanity unit. All except ceramic sinks will require a combined overflow/waste outlet, like a bath. It pays to fit a tubular trap to a sink, because a bottle trap blocks too easily.

1. Install the base plate
2. Retract the pullout hose
3. Slip the mounting nut and washer
4. Slide the hose weight

Figure 3.81 Steps of Installation of sink

Kitchen sinks are usually placed on cabinets made of wood, plastics or other materials to begin with assemble a mixer and cold and hot water supply.

- Mount the sink on a cabinet.
- Connect the supply pipes, drain and trap.
- Join the trap to fixtures.
- Bring the sink in to a level position

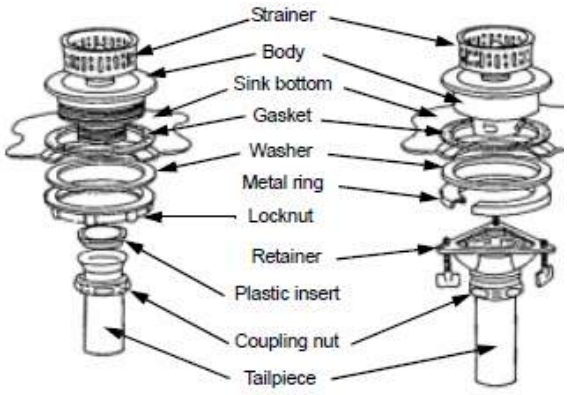


Figure 3.82 Kitchen sink drain assembly

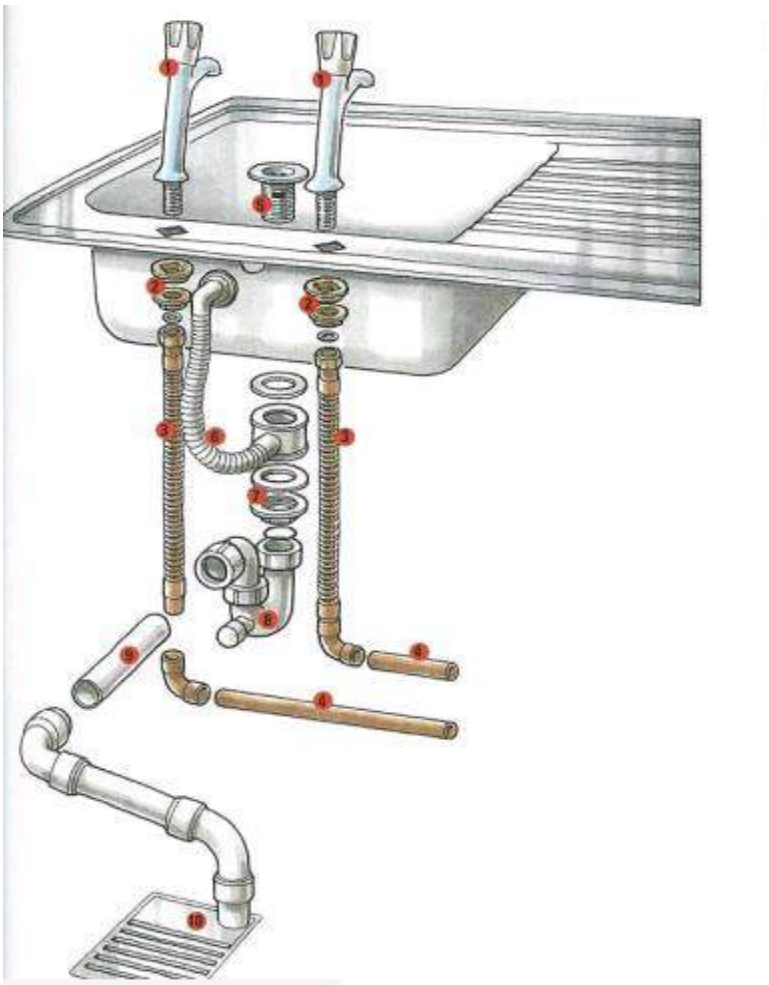


Figure 3.83 Detailed component of Kitchen sink

Plumbing of sink

1. Pillar trap
2. P-Tap back-nut and top-hat washer
3. Flexible copper pipe
4. Supply pipe
5. Waste outlet
6. Banjo overflow unit
7. Waste back-nut and washer
8. Trap
9. Waste pipe
10. Yard gully

Hook Up a Kitchen Sink Drain

1. Attach the drain tailpiece to the threaded outlet of the strainer body
2. Apply plumber's putty around the perimeter
3. May need to cut a trap arm or drain tailpiece to length
4. Attach the trap arm to the male-threaded drain stubout
5. Attach a waste tee fitting to the drain tailpiece
6. Join the short end of the outlet drain pipe to the tailpiece
7. Attach the long leg of a P-trap to the waste tee/or other

Figure 3.84 Hook up a Kitchen Sink Drain

Installing an Integral Vanity Top

- Set the sink-countertop unit onto sawhorses.
- Thread the locknut and sealing gasket onto the drain tailpiece, then insert the tailpiece into the drain opening and screw it onto the drain flange.
- Place a small amount of pipe dope on all threads.

- Center the sink-countertop unit over the vanity so the overhang is equal on both sides and the backsplash of the countertop is flush with the wall.
- Cabinets with corner braces: Secure the countertop to the cabinet by driving a mounting screw through each corner brace and up into the countertop.
- Attach the drain arm to the drain stub-out in the wall, using a slip nut.
- Seal the gap between the backsplash and the wall with tub and tile caulk.

Figure 3.85 Installing an Integral Vanity Top

Detailed steps to install slop sink

- Assemble the sink.
- Attach the trap.
- Install and hook up the faucet.

Figure 3.86 Detailed steps to install slop sink

3.10.3 Types of sink faucet

Compression Faucets

Figure 3.87 Compression Faucets

Washerless Two-Handle Faucet

Figure 3.88 Washerless Two-Handle Faucet

One-Handle Cartridge Faucets

Figure 3.89 One-Handle Cartridge Faucets

Ball Faucets

Figure 3.90 Ball Faucets

Disc Faucets

Figure 3.91 Disc Faucets

3.10.4 Clearing and repairing of sink

Leak of sink

A leak under a sink may be caused by astrainer body that is not properly sealed to the sink drain opening. To check for leaks, close the drain stopper and fill sink with water from under neath sink, inspect the strainer assembly for leaks. Remove the strainer body clean it, and replace the gaskets and plumber's putty or ,replace the strainer with anewone, available at homecenters.

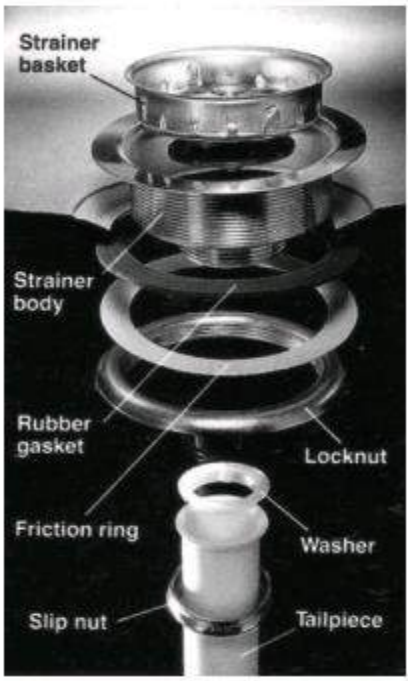
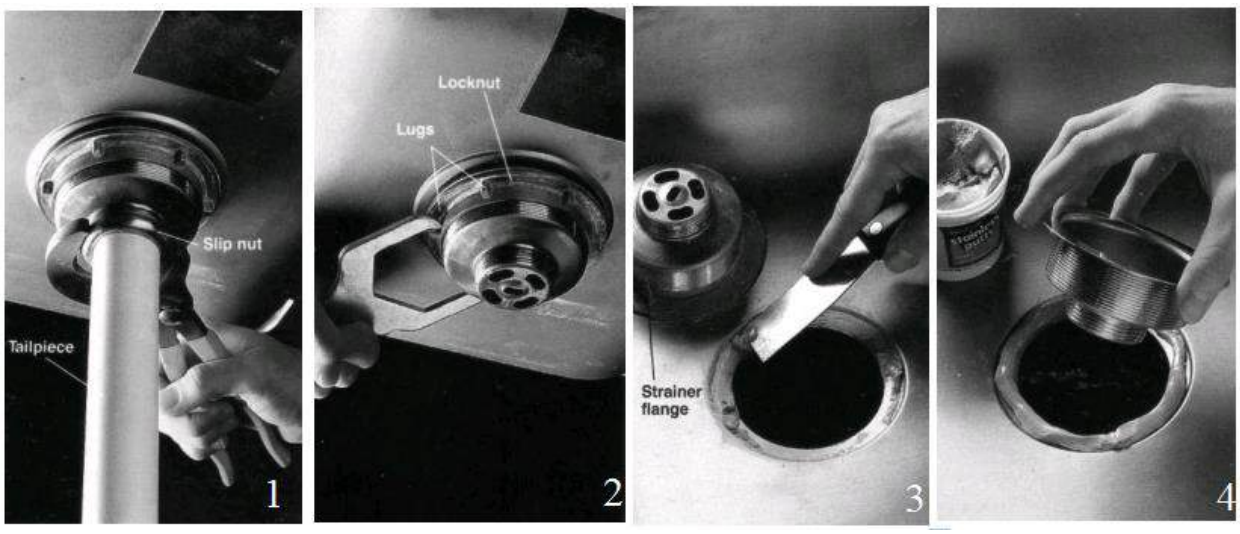


Figure 3.92 Leak on sink

Claen and Maintain sink

- Unscrews lip nuts from both end soft ailpiece,using channel type pliers.
- Remove the lock nut, using a spud wrench.
- Remove old putty from the drain opening, using a putty knife.
- Apply abead of plumber's putty to the lip of the drain opening.



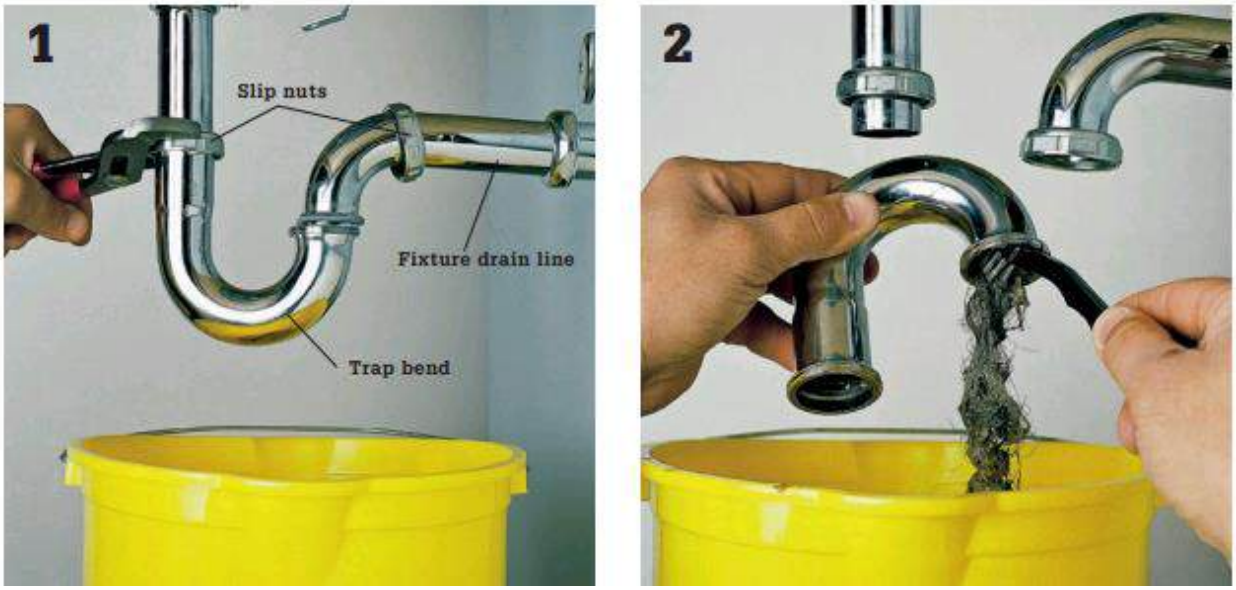


Figure 3.93 Remove and Cleana Sink Drain Trap

Clean and Adjusta Pop-up Sink Drain Stopper

1. Raise stopper lever to full up right (closed) position. Unscrew the retaining nut that holds pivotrod in position.Pull pivotro dout of drain pipe to release stopper.
2. Remove stopper. Clean debr is from stopper, using asmall wire brush. Inspect gasket for wear or damage, and replace if necessary. Reinstall stopper.
3. If sink does not drain properly, adjust clevis. Loosen clevis screw. Slide clevis up or down on stopper rod to adjust position of stopper. Tight enclevis screw.

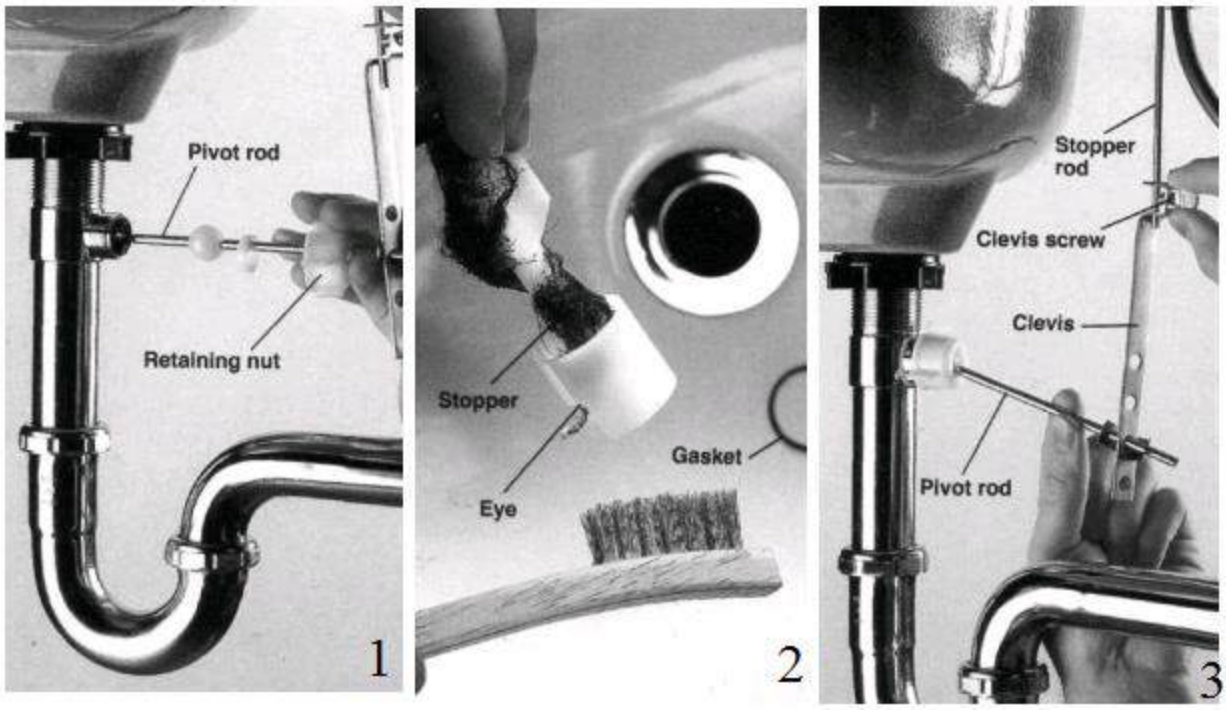


Figure 3.94 Steps Clean and Adjusta Pop-up Sink Drain Stopper

Clear Sink Drains with a Plunger

1. Remove drain stopper Some pop-up stoppers lift outdirectly; other sturn counter clockwise. Onsome older types of stoppers, the pivot rod must be removed to free the stopper
2. Stuff awetrag in sink over flow opening. Rag prevents air from breaking the suction of the plunger place plunger cup over drainand run enough water to cover the rubber cup. Move plunger handle up and down rapidly to break up the clog.

Figure 3.95 Plunger

Figure 3.96 Clear Sink Drains with a Plunger

Force cup

The blockage is cleared by filling the appliance (say a kitchen sink) with water. Next, press down repeatedly on the handle of the force cup. This creates a positive pressure on the blockage, and a partial vacuum when it is withdrawn, which is usually enough to remove the blockage. Always check the trap for signs of leakage when you have finished. Figure 3.97 shows a force cup.

Figure 3.97 Force cup

3.10.5 Maintaining and Repairing of Sink faucet

Steps to Repairing and maintaining faucet

1. To remove the old faucet, start by clearing out the cabinet under the sink and laying down towels
2. Spray penetrating oil on tail piece mounting nuts and supply tube coupling nuts. Remove the coupling nuts with abas in wrench or channel-type pliers.

3. Remove the tail piece mounting nuts with abas in wrench or channel- type pliers. Bas in wrench has along handle that makes it easy to work in tight areas.
4. Remove faucet. Use a putty knife to clean away old putty from surface of sink.

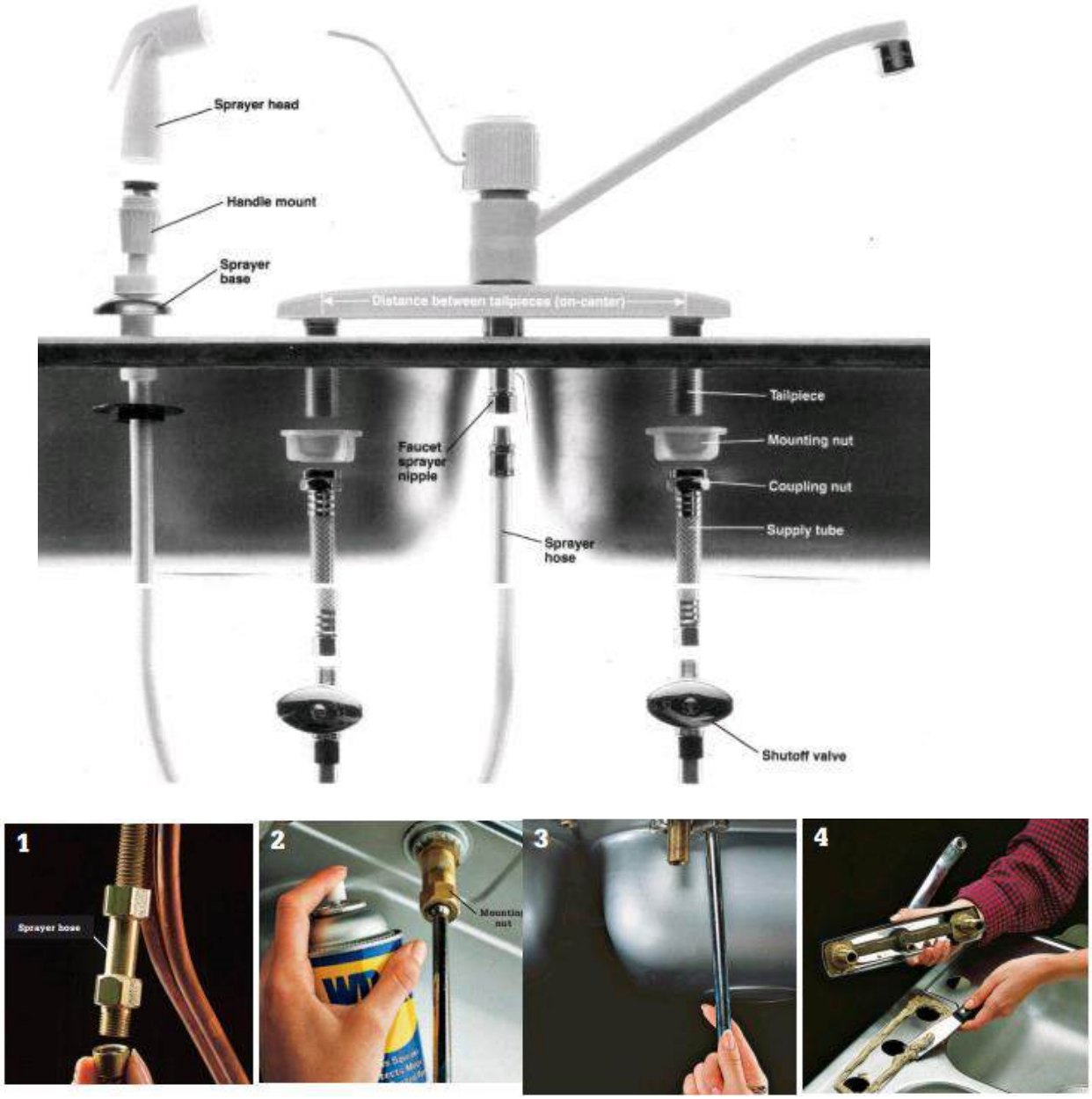


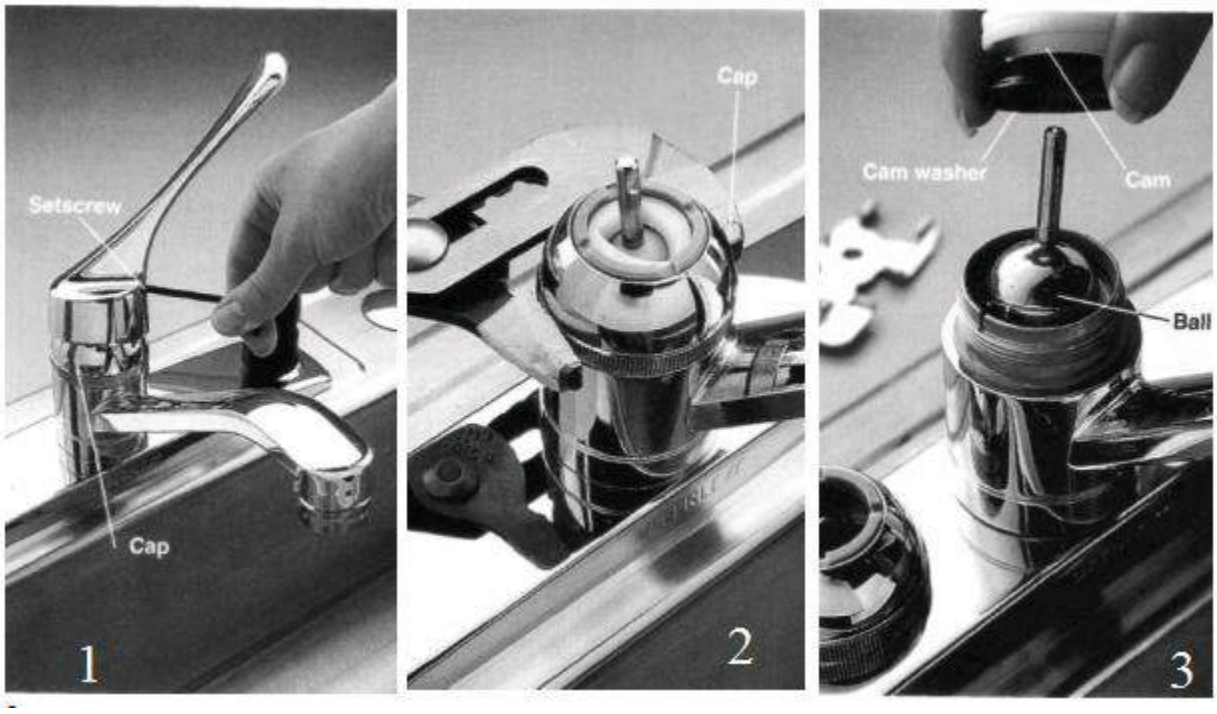
Figure 3.98 Maintaining and Repairing of Sink faucet

Leak of Faucet

A leaky faucet is the most common home plumbing problem. Leaks occur when washers, rings, or seals inside the faucet are dirty or worn.

To ensure a correct selection, you may want to bring the worn parts to the store for comparison.

1. Loosen handle setscrew with an Allen wrench. Remove handle to expose faucet cap.
2. Remove the cap with channel type pliers.
3. Lift out the faucet cam, cam washer, and the rotating ball.
4. Reach into the faucet with a screw driver and remove the old springs and neoprene valve seats.
5. Remove spout by twisting it up ward, then cutoff old-rings.
6. Reattach the spout. Screw the retaining ring on to the faucet, and tighten with channel-type pliers. Attach the handle, handle screw, and index cap.



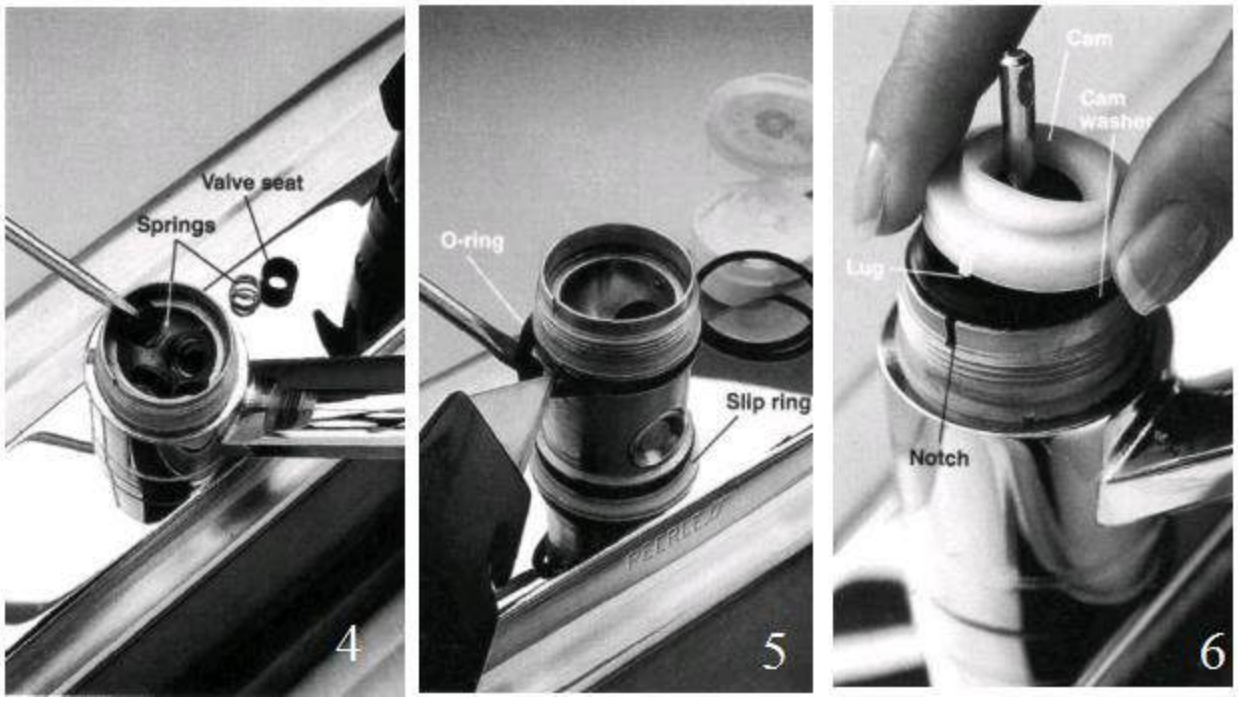


Figure 3.99 Leak of Faucet

3.11 Inspection of damage in fixtures and installed pipe system

It is essential to carry out soundness testing on completed hot water and cold water installations if you are to leave the installation leak free. Soundness testing of cold and hot water systems usually includes

- **Visual inspections**
- **Testing for leaks**
- **Pressure testing**
- **Final checks.**

Procedures for carrying out soundness testing

The standard for soundness testing on cold and hot water systems.

Visual inspection

This includes making sure that all pipework and fittings are thoroughly inspected to ensure

- They are fully supported, including cisterns and hot water cylinders
- They are free from jointing compound and flux
- That all connections are tight

- That terminal valves (sink taps, etc) are closed
- That inline valves are closed to allow stage filling
- The storage cistern is clean and free from swarf.

It is useful at this stage to advise the customer or other site workers that soundness testing is about to commence. It would also help if notices were placed on sinks, etc advising that the pressuretesting was in progress.

Testing for leaks

When testing for leaks, you should follow this checklist:

- Slowly turn on the stop tap to the rising main
- Slowly fill in stages to the various service valves, and usually inspect for leaks on each section of pipework, including fittings
- Open service valves to appliances, fill the appliance and again visually test for leaks
- Make sure cistern levels are correct
- Make sure the system is vented to remove any air pockets prior to pressure testing.

Pressure testing

Pressure testing of installations within buildings is done using hydraulic pressure testing equipment.

Final system checks

After the system tests have been completed, carry out a final visual check for leaks. Advise the customer and/or other site workers that testing is complete. Make sure the system is thoroughly flushed out before it is commissioned.

Self-Check-3	Written Test

Instructions: Answer all the questions listed below. Each quotation contains (5ponts).

1. List out at least 3 Common fixtures?
2. State the types of bath?
3. List the detailed procedures of bidet installation?
4. Mention at least 4 types of lavatories/hand washbasins?
5. Explain the tools clear stoppages in WC?
6. List at least 4 types of water closet?
7. Briefly explain the steps of mounting floor-mounted water closet bowl?
8. What are the steps of repair shower faucets?
9. Identify the processes of kitchen sink installation?
10. Mention the 4 types of inspection of damage in fixtures?

OPERATION SHEET-3

OPERATION TITLE:- Install service, maintenance and fit off sanitary fixtures

PURPOSE:- Install, maintain, repair, and fit sanitary fixtures

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-

- ✓ Wear appropriate safety protection
- ✓ Ensure the work is hazard free
- ✓ Ensure the working area is bright / good visibility
- ✓ Make workstation comfortable
- ✓ Handling maintenance work of fixtures.
- ✓ Work on the installation process of fixtures.
- ✓ Have enough available tools and equipment's.

EQUIPMENT TOOLS AND MATERIALS : -

Wretch, pipe cutters, chalk lines, drill, hammers, marking equipment ,measuring tapes , hand saw, water levels, trowel, float, fittings, pipe, faucets, fixtures, joints, de-burring, reamer, stock head, dies, diestock, signage, string, cold chisel, tubing cutter, fine-tooth hacksaw, heating torch, nonacid solder, soldering flux, machine bender, miter box or jig, and pocketknife

PROCEDURE,

a) Identify damage of fixture
b) Analysis what is needed for maintenance and installation
c) Fixing components to give solutions that meet the Highest Quality Standards
d) Installing pipe system considering different criteria's.
e) Replacing and maintain fixture components
f) Applying Test Procedures

PRECAUTIONS:-

- ➢ Take safety measure (PPE) in appropriate way
- ➢ Make working area hazard free
- ➢ Read and interpret manuals, plans, specifications and drawing components.

QUALITY CRITERIA:

Assured the performance of all the activities according to the given guide.