UNIT-1

PLUMBER'S TOOLS

Plumbing system: -Plumbing, system of pipes and fixtures installed in a building for the distribution and use of potable (drinkable) water and the removal of waterborne wastes. It is usually distinguished from water and sewage systems that serve a group of buildings or a city.

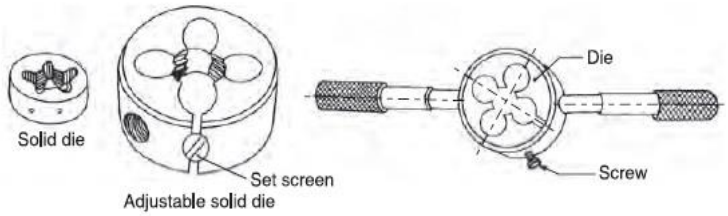
The main purpose of a plumbing system: -Is to deliver clean water in every residential and commercial building and, at the same time, eliminate all wastewater.

Plumbing Hand Tools

1. Threading die
2. Bit Brace
3. Ratchet Brace
4. Pipe wrench
5. Basin wrench
6. Spanner Set
7. Pipe Cutter
8. Pipe vice
9. Hacksaw
10. Chisel
11. Bench drilling machine
12. Soldering iron

Threading dies and taps

In order to provide the external threads over the surface of pipes, threading dies and taps are used. Threading dies and taps are displayed here in following figure.



Threads will be developed in different shapes and sizes which will be used by fitting pipes inside a die handle. Length of thread will be dependent over the size of the pipe.
Pipe will be fixed in vice and threads will be made with the help of die and die handle.

2. Bit Brace: - brace and bit, hand-operated tool for boring holes in wood, consisting of a crank-shaped turning device, the brace that grips and rotates the hole-cutting tool, the bit.

3. Ratchet Brace: - The Ratchet Brace, also known as Brace and Bits, is a hand-tool used to drill holes or nails into wood. The linear motion of its crank-shaped handle can provide ample torque when drilling.

4. **Pipe wrench: -** The pipe wrench serves as a plumber's largest wrench. Plumbers use these heavy tools to tighten and loosen nuts and fittings on pipework. They typically use two of these wrenches together—one to hold a pipe in place and the other to rotate the nut or fitting in the appropriate direction. Pipe wrenches come in various lengths, and prepared plumbers typically work with an entire set of these tools.

5. **Basin wrench: -** The basin wrench is a T-shaped tool plumbers use specifically to work on faucets. The clamp-like mechanism on one end of these wrenches allows plumbers to reach into narrow spaces and loosen or tighten the nuts that keep our faucets working (and not leaking)

6. **Adjustable Wrench:**-The adjustable wrench tightens and loosens hexagonal nuts and fittings on pipes. These wrenches come in various sizes, but plumbers most often have the 6- and 10-inch versions on hand.

7. **Spanner Set: -** The spanners are the fitting plumbing tool that is used to loosening or tightening the standard size nuts and bolts. The various types of spanners are available in market mentioned as below.

7.1 Ring Spanners

Ring spanners are included circular closed rings at both ends. Uses of ring spanners sometimes cause damage due to slips.

7.2 Open-Ended Spanners

Open-ended spanners include the open jaw at both ends of spanners that is mostly used to open or close the nut and bolts.

7.3 Combination Spanners

Combination spanners include the combination of Ring and Open-ended spanners. It is one end with a circular ring while other ends consist open-ended jaw.

7.4 Bi-Hexagonal Ring Spanners

Bi-hexagonal spanners include the hexagonal rings at both ends to hold and open nuts and bolts. It is available in the market in various sizes.

8. **Pipe Cutter: -**Pipe cutter is one of the most common types of plumbing tool that is used to cut water, sanitary, or sewer pipes. Generally, Solid type, Hook Type, and chain type pipe cutters are mostly used. Pipe cutter includes the cutting reels, moving reels base, screw, and adjusting handles. Moving reels base is adjusted as per pipe size with the help of adjusting screwed handle. The pipe was cut by a rotating cutter surrounding it.

9. **Pipe vice:-** Pipe vice is a holding Plumbing tool that is used to hold the pipe for carrying out cutting, threading, assembly, disassembly, etc. purposes. There are two types of pipe vices.
   1. Open Side Pipe Vice
   2. Fixed Side Pipe Vice

   Pipe vice includes the set of the jaw; one is fixed while another is moveable to adjust as per the size of pipe.

Pipe vice

10. **Hacksaw: -** Hacksaw is a cutting plumbing tool that is used to cut the plastic pipes, steel hollow roads, steel thin sheets, angles, etc. Hacksaw includes the handle, frame, blade and adjustable wing screw. Cutting operation using manually operated hacksaw includes the forward stroke and reverse stroke, where the forward stroke is known as cutting stroke while reverse stroke is known as idle stroke.

11. **Chisel: -** It is made of hard metal and is mostly used for cutting concrete surface and making grooves in the walls with the help of a hammer.

12. **Bench drilling machine: -**The bench drill is used for drilling holes through materials including a range of woods, plastics and metals. It is normally bolted to a bench so that it cannot be pushed over and that larger pieces of material can be drilled safely.

13. **Soldering iron: -** A soldering iron is a hand tool used to heat solder, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the workpieces needing to be joined.

EXERCISE

A. FILL IN THE BLANKS:-

1. The tools which are used for holding the pipes, pipe fittings in plumbing operations are called **holding Tool.**
2. The pipe vice are of two types **Fixed Side** and **Open Side.**
3. In bench vice one jaw is Fixed and other is **Moveable.**
4. Fitting tools are **wrench, water pump, pliers and spanner.**
5. For tightening and loosening of nuts and bolts of standard size **Spanner** tools in used.
6. The spanner which is open on both sides is called **open ended spanner**
7. The spanner which is fully circular closed ring at both ends is called **ring spanner**
8. The tools which are used for cutting the pipes, fixtures and bolts etc. is known as **combination spanner**
9. Hack saw is a **cutting tool**.
10. The instrument or tool used to bend and bend the pipes is called **pipe bending machine.**
11. **Threading die** is used for making threads on a pipe.
12. A bit brace is used to bore a **hole.**
13. Chisel is made of **hard metal.**

B. Short Answer Types Questions:

1. Define Holding Tools.
2. Wrench.
3. Name the different types of spanners.
4. Define cutting tool.
5. For what purpose pipe cutter is used.
6. Define pliers.
7. For what purposes trowel is used.
8. Define spade.

C. Long Answer Types Questions:

1. Name the different tools required in plumbing.

2. Write the rules to be followed for designing and installing plumbing system.

3. Explain the term Plumbing and role of plumbing.

4. Define plumber. Explain the skills required for plumber.

5. Write note on ratchet brace.

UNIT-2
PIPES & PIPE FITTING

2.1 Plumbing Pipes: - As you are aware, pipes are used for different purposes like transporting water for drinking, irrigation purpose, disposing the waste water, etc. Plumbing pipes are manufactured in various sizes, mostly in a round shape. These pipes are made of various types of material as mentioned below.

Types of plumbing pipes: - Commonly used pipes for plumbing system are listed below.

1. Galvanized Iron (GI) pipes
2. Plastic pipes
3. PVC pipes
4. HDPE Pipes
5. Cast Iron (CI) pipes
6. Steel pipes
7. Copper pipes
8. Asbestos Cement (AC) pipes
9. Concrete pipes
10. Stone ware pipes

1. Galvanized Iron (GI) pipes: - G.I pipes are made of mild steel sheet. Its length-wise joint is Welded Seam Type. G.I pipe is used to supply gas, water, or any other liquid within the building. These types of pipes are prepared from 12 mm to 150 mm in diameter. They can be found in 6 meters length.

The thickness of the wall of its sheet is different based on their diameters. After preparing this pipe, it's dipped in a zinc solution. This action is called Galvanizing. In this way, the pipe is saved from rusting.

The average age of this pipe is ten years. They may be joined easily, threading, cutting, and bending them is also an easy task. They are joined with the help of a socket. These pipes are light-weighted and cheap. Acidic and alkaline waters affect these pipes badly.

2. **Plastic pipes: -**is a tubular section, or hollow cylinder, made of plastic. It is usually, but not necessarily, of circular cross-section, used mainly to convey substances which can flow—liquids and gases (fluids), slurries, powders and masses of small solids. It can also be used for structural applications; hollow pipes are far stiffer per unit weight than solid members.

3. **PVC pipes: -** (Polyvinyl Chloride) These pipes are mostly used for carrying water in the plumbing system and are light in weight, non-corrosive, cheaper in cost and need not require any threading for joining connections. It makes them easily acceptable in the market.

(i) **Chlorinated PVC (CPVC) pipes: -** These pipes can be used for higher temperatures up to 120°C, and are therefore suitable for supplying hot water and are mostly used in industrial liquid application.

(ii) **Unplasticised Polyvinyl pipes: -**Unplasticised PVC is also known as rigid PVC, PVC-U is the most common PVC type for pipes and fittings including transportation of drinking water, soil and waste, sewage and underground drainage and industrial applications.

4. **HDPE Pipes:** - HDPE pipe is a type of flexible plastic pipe used for fluid and gas transfer and is often used to replace ageing concrete or steel mains pipelines. Made from the thermoplastic HDPE, its high level of impermeability and strong molecular bond make it suitable for high pressure pipelines. High-density polyethylene pipe (HDPE) can carry potable water, wastewater, slurries, chemicals, hazardous wastes, and compressed gases.

5. **Cast Iron (CI) pipes: -** Cast Iron pipe is popular for city water-distribution systems due to its high resistance to corrosion and consequent long life. Cast iron pipe is made of pig iron. Such pipes are generally made from 5 cm to 120 cm in diameter. Under normal conditions, a cast-iron pipe could be expected to last 100 years. The usual length of a pipe section is 12 feet, but lengths up to 20 feet may be obtained. Cast iron pipe is made in several wall thickness classes for various pressures up to a maximum of 350 psi.

Cast Iron pipes have the following advantages—

(a) They are cheaper in cost.
(b) They have more resistance to rust and corrosion.
(c) They are highly durable. CI pipes are uniform in thickness.

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6. **Steel pipes: -** Steel pipes are cylindrical tubes made from steel that are used many ways in manufacturing and infrastructure. They're the most utilized product made by the steel industry. The primary use of pipe is in the transport of liquid or gas underground—including oil, gas, and water.

7. **Copper pipes: -** These are mostly used for hot water installation requirements. They have high tensile strength. These are made from thin copper sheet and can be folded easily. Chromium is coated on copper pipes for better appearance.

8. **Asbestos Cement (AC) pipes:-**For removal of water (from the roofs), soil and waste, and for purifying the air, asbestos cement pipes are used.

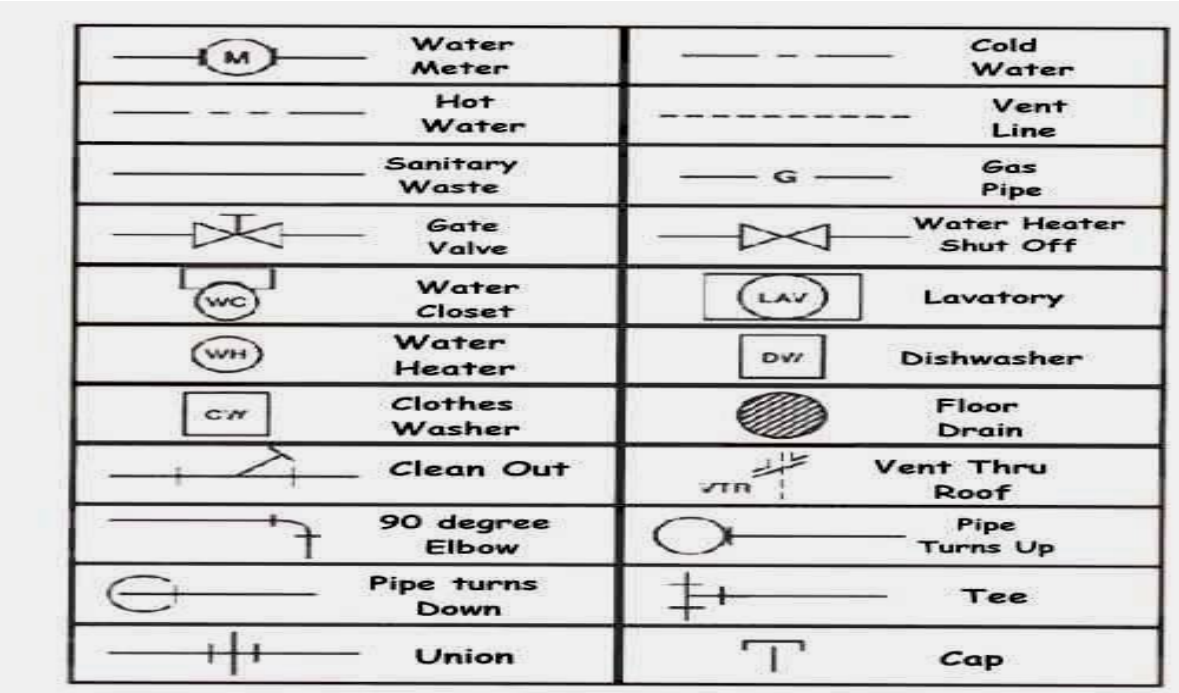
Two types of AC pipes are made: - one with a beading around the socket (With Beading), and the other without beading around socket (Without Beading).

The Without Beading around socket (WOB) type is mostly preferred over the one with beading. These pipes are available in the range of three meters of length. They are heavy and can break easily. The cost of these pipes is less than the PVC pipes. Nowadays, AC pipes are being replaced by PVC pipes.

9. **Concrete pipes:-** Concrete pipes are made of plain concrete (mixture of broken stone or gravel, sand, cement and water), which is considered to be one of the strongest and most durable building material. Concrete pipes also come in different categories like unreinforced pipes, reinforced pipes and pre-stressed pipes. Small unreinforced concrete pipes are mostly used for removal of water. And for water supply works, pipes with bigger diameters are used

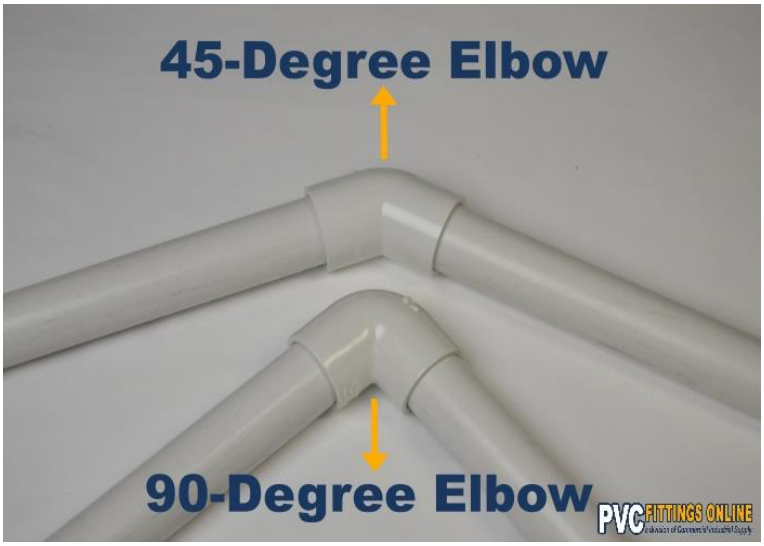
10. Stone ware pipes: - These are made of clay, and are primarily used in sewerage system for underground drainage, industrial drainage, irrigation, chemical industry for transporting the highly corrosive chemical, etc. Stone Ware (SW) pipes are mostly used to carry night soil and

2.2 Plumbing Symbols: -It involves using pipes, valves, plumbing fixtures, tanks, and other equipment. This equipment is used for heating and cooling, waste removal, potable water delivery. Plumbing symbols denote all the technical tools used for water and gas supply.



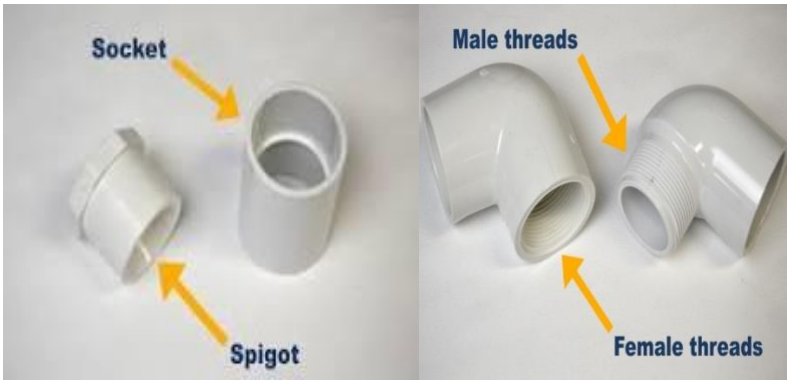
2.2 Bends: -Bend is a generic term for any offset or change of direction in the piping. It is a vague term that also includes elbows.

2.3 Elbows: - Steel pipe elbow (sometimes also refereed as bends) is a key part in a pressure piping system used to change the fluid flow direction. It is used to connect two pipes with same or different nominal diameters, and to make the pipe and thus the fluid direction turn to a certain direction of 45 degree or 90 degree.



2.4 Sockets: - A socket is a fitting that simply goes over the end of a pipe. A 1" socket end will fit on a 1" pipe. These are extremely common. Many PVC couplings have socketed ends.

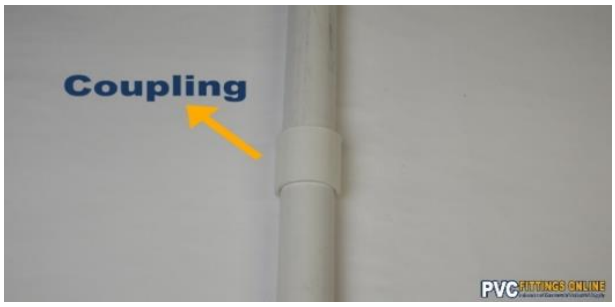
Socket/Spigot: - A socket fitting indicates a female fitting and a spigot refers to a male fitting. A socket/spigot fitting can work as either a socket or spigot. For example, a ½" socket connection can slip over ½" PVC pipe or inside a larger ¾" PVC fitting.



2.5 TEE: - Pipe Tee is **a type of pipe fitting which is T-shaped having two outlets, at 90° to the connection to the main line**. It is a short piece of pipe with a lateral outlet. Pipe Tee is used to connect pipelines with a pipe at a right angle with the line. Pipe Tees are widely used as pipe fittings.

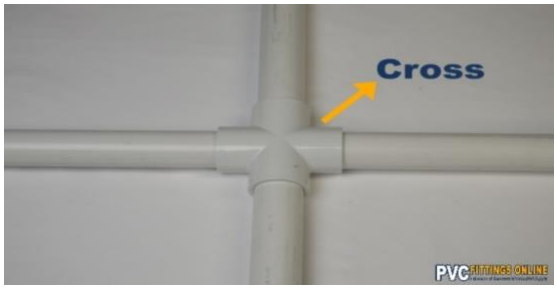
2.6 COUPLING & UNION :-

Couplings: - are one of the most simple (and inexpensive) types of PVC fittings. They are a small part that connects or "couples" one part to another, usually permanently. They can connect pipe to pipe and pipe to fitting. Some of them even reduce so you can connect a small pipe to a large pipe or vice versa. Couplings are available with slip or female-threaded ends, depending on what you need them for.



Unions: - like couplings connect things, but they are a not-as-permanent solution that can be easily taken apart. PVC unions are often used in building temporary structures, such as tent supports, and can be taken apart when the structure is no longer needed. They feature a ring in the center that separates the two ends from each other, allowing for easy deconstruction and maintenance.

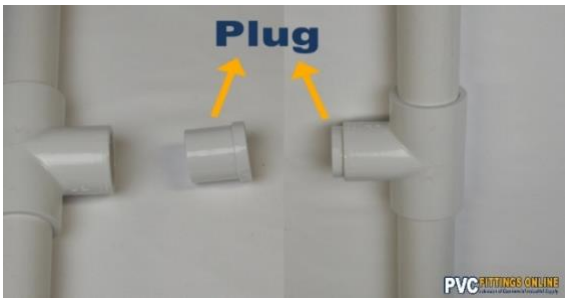
2.7 Crosses: -Crosses are a slightly less common type of fitting that join four pipe sections. They have four slip connections (S x S x S x S) that meet at 90-degree angles, forming a "plus" shape. PVC cross fittings are usually used when building framework out of PVC pipe. Crosses can add a great deal of structural integrity to a framework. They can also be used to divide fluid flow in different directions.



2.8 Caps and Plugs

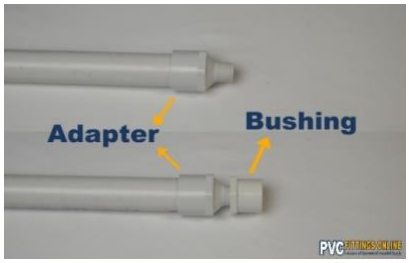
Caps: - have a very simple job: stop the flow. They are put on the end of a pipeline that does not need to be connected to another pipe. They can stop a pipeline that you plan on expanding later or give you easy access to a system when needed. They can also add a finished look to pipe in PVC building projects. Caps go around or outside the pipe, so they can have either a socket or female-threaded end.

Plugs: - are like caps, but instead of stopping the flow in a pipe, they stop the flow in a fitting. Because of this, plugs go inside the fitting. This means they either have a spigot or male-threaded end.



2.9 Adapters (Female and Male)

Adapters: - sometimes called reducing couplings, are a versatile fitting. These fittings are designed to change the end type of a pipe, allowing it to connect to fittings and pipes of many sizes. They can have threaded or slip socket ends to connect to an endless variety of pipes and fittings. Adapters can be either male- or female-threaded, as well as socket or spigot.



2.10 Bushings

Bushings: - are a lot like adapters, but with a focus on connecting pipes of different diameters by reducing the fitting. (Bushings cannot reduce pipe.) Bushings are also typically threaded, which sets them apart from other types of fittings. This allows for different kinds of connections and makes maintenance and pipeline customization easier. Bushings are often seen in landscaping and aquaculture applications because they work better with water than metal fittings that may rust.

2.11 How to Cut Pipe and Tubing

- **Pipe Cutting: -** In plumbing systems, tubes and pipes can be formed of materials of different flexibility and density, such as PVC, PEX, cooper, galvanized steel and cast iron. When making plumbing repairs and improvements, use different pipe and tube cutters based on the type of material, although the methods tends to be very similar. Follow this guide to know which cutting tool and method is suitable for which type of pipe.

- **Before Cutting Pipe and Tubing**

No matter the material, measure the diameter of the pipe or tube to be cut to ensure that you use the right-size tube cutter for the job.

When determining how to make a straight cut, use a tape measure and a pencil or other writing instrument to mark on the surface where you want to cut. If possible, mark around the circumference of a pipe, especially when cutting with a handsaw.

Ensure that a cut is as straight as possible by securing the pipe with a vise, clamp, and miter box or even duct tape to keep the length from shifting out of place while cutting.

- **How to Cut PVC Pipe:-**

Rigid pipe can be cut with such PVC pipe and tube cutters as hacksaws, power miter saws and scissor-type cutters, but ratchet-style cutters tend to strike an effective balance of affordability, flexibility and ease of use.

With a hacksaw, slowly draw the blade back and forth, making sure that the cut is straight. Reduce speed near completion to provide a clean cut at the end.

With scissor-style cutters, begin by placing the pipe inside the jaws of the cutter, making sure that the blade lines up with the mark. Apply pressure to the handles and slowly rotate the cutter around the pipe. Making sure the cut is straight, continue to rotate until you cut through the pipe. Scissor-type tends to be best with pipe thickness of one inch or less.

With ratchet-style cutters, arrange the blade over the mark, then squeeze and release the handle. Continue the ratcheting action until the pipe is severed into two pieces.

When using a miter saw, secure the pipe at the mark under the saw blade at the workbench. Activate the saw and slowly bring it down until it severs the piece. Turn off the saw and wait for the blade to stop spinning before removing the pipe.

- **How to Cut Copper Pipe**

Standard copper pipe and tubing cutters are sufficient to cut copper pipe, both rigid copper plumbing pipe and flexible copper tubing.

Align the cutter around the mark and tighten so that the blade scores the pipe.

Rotate the cutter around the pipe, following the score and slightly tightening every few rotations until the pipe walls have been cut through.

- **How to Cut Galvanized Steel Pipe**

Galvanized pipe is made of steel with a zinc coating to reduce corrosion and rust inside the pipe. Heavy-duty steel pipe and tube cutters are usually the easiest to use, but for tight spaces, an angle grinder or reciprocating saw may be needed.

When using a metal pipe cutter, align the tool around the marked place on the galvanized pipe and rotate so that the wheel cuts deeper into the pipe until severed.

When using an angle grinder or reciprocating saw, start the tool before contacting the pipe, then slowly lower the cutting disc until it contacts the surface. Apply steady pressure until it severs the pipe.

When using a hacksaw, slowly draw the blade back and forth, making sure that the cut is straight. Make sure you use a hacksaw with fine teeth for cutting metal, and not one with larger teeth for cutting wood. Be patient as this can take longer than using a hacksaw on PVC pipe.

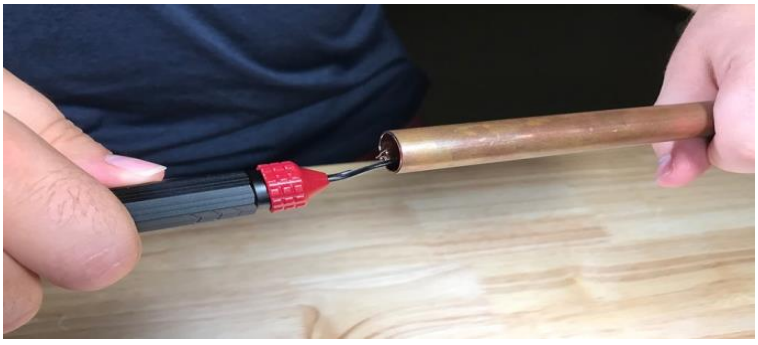
Safety: Wear protective glasses, work gloves and long sleeves when using a power tool to cut through metal pipe.

- **How to Cut PEX Tubing**

PEX (an abbreviation for cross linked polyethylene) is an increasingly popular form of plastic pipe that can substitute for copper or galvanized steel in some cases. Use a specialized scissor-style or ratchet-style PEX pipe and tubing cutter.
Before cutting, straighten the PEX tubing as much as possible and mark the cut.
Align the cutter, gently squeeze the handles and rotate the cutter until the PEX tubing is cut.

- **How to Cut Cast Iron Pipe**

Cast-iron pipe, frequently used in older homes, will often be too thick and heavy-duty for a standard cutter or saw, requiring the use of a cast-iron cutter.
When using a chain-style cutter, begin by placing the cutting chain around the pipe.
Hook the chain into the jaw of the cutter.
Ratchet the handle back and forth until the pipe is severed.
After Cutting Pipe and Tubing



Unless a cut is perfectly clean, you should expect to remove burrs from around the edge, especially after sawing. Use a debarring tool to clean the edge after tube cutting. You may opt to use a metal file on the cut of a metal pipe.

NOTE: Learning how to use pipe and tubing cutter can mean simply matching the right tool to the right material and following the correct procedure.

2.12 Bending Processes for Pipe Fitting

- **Pipe and Tube Bending: -** Pipe bending machines are typically human powered, pneumatic powered, hydraulic assisted or electric servo motor. In the pipe bending operation the tube may be supported internally or externally to preserve the cross section of the pipe. In operations where there is flexibility in the shape of the pipe, the pipe does not need to be supported, however there will be some deformation in the both the cross section of the overall pipe and the wall thickness in different areas of the bend.

- **Tube bending** as a process starts with loading a tube into a pipe bender and clamping it into place between two dies, the clamping block and the forming die. The tube is also loosely held by two other dies, the wiper die, and the pressure die. After that has been completed the fitter will start the bender, while the tube is pulled around the forming die creating an elbow, U-bend, 2-D or 3-D bent tubes. A three-dimensional tube is a tube with each opening on different planes. A two-dimensional tube is a tube with each opening on the same plane. The picture below shows typical manual pipe benders with the main parts named.

- **Types of Bending Processes and Equipment Used**

  Pipe bending techniques are varied and offer different advantages and disadvantages depending on the function of the bend and the type of material being bent. Some use mechanical force and some use heat treatment, the most common are as follows:

  - Press Bending
  - Rotary Draw Bending
  - Mandrel bending
  - 3 Roll Bending
  - Bending springs
  - Heat induction bending
  - Sand packing/hot slab bending

- **Press Bending: -** Press bending is the simplest and cheapest method of bending cold pipe and tube. The pipe or tube is restrained at two eternal points and a ram in the shape of the bend advances on the central axis and deforms the pipe.

  The bent pipe or tube is prone to deformation on both the inside and outside curvature. The pipe or tube is often deformed into an oval shape depending on the wall thickness of the material. This process is used where a consistent cross section of the pipe is not required.

  This type of bending is suitable for bending electrical conduit and similar light gauge product.

- **Rotary Draw Bending:-** This is the most commonly used style of bender for bending pipe and tube where maintaining a good finish and constant diameter is important.
  Rotary draw benders (RDB) are precise in that they bend using tooling or "die sets" which have a constant center line radius (CLR). The die set consists of two parts: The bend die creates the shape to which the material will be bent. The pressure die does the work of pushing the straight material into the bend die while traveling the length of the bend. Often a positioning index table (IDX) is attached to the bender allowing the operator to reproduce complex bends which can have multiple bends and differing planes.
  Rotary draw benders are the most popular machines for use in bending tube, pipe and solids for applications like: handrails, frames, instrument tubing and much more. Rotary draw benders create aesthetically pleasing bends when the right tooling is matched to the application.

- **Mandrel Bending: -** Mandrel benders are similar to the rotary draw bender but use an additional wiper die on the outside of the tube and a mandrel which is inserted into the tube which remains inside the tube during the bend process. This internal mandrel helps to support the shape of the wall when bending. Typically, a mandrel bender is needed when bending thin wall tubing to a radius much tighter than the material can bend without collapsing or distorting.

- **3-Roll Bending: -** 3-roll bending is also used for producing work pieces with large bending radii. The method is like the ram bending method, but the working cylinder and the two stationary counter-rollers rotate, thus forming the bend. Normally there are 2 fixed rollers and one moving roller, and the work piece is passed forward and backward through the rollers while gradually moving the working roller closer to the counter rollers which changes the bend radius in the pipe. This method of bending causes very little deformation in the cross section of the pipe and is suited to producing coils of pipe as well as long sweeping bends like those used in powder transfer systems where large radii bends are required.

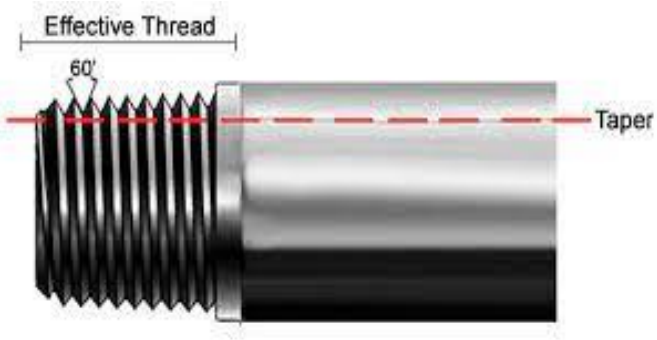
- **Bending springs: -** These are strong but flexible springs inserted into a pipe to support the pipe walls during manual bending. They have diameters only slightly less than the internal diameter of the pipe to be bent. They are typically only used for bending 15-to-25 mm soft copper pipe (used in household plumbing). The spring is pushed into the pipe until its center is roughly where the bend is to be. A length of flexible wire can be attached to the end of the spring to facilitate its positioning and removal. The pipe is generally held against the flexed knee, and the ends of the pipe are pulled up to create the bend. To make it easier to retrieve the spring from the pipe, it is a good idea to bend the pipe slightly more than required, and then slacken it off a little. They are less cumbersome than rotary benders but are not suitable for bending short lengths of piping when it is difficult to get the requires leverage on the pipe ends. Bending springs for smaller diameter pipes (10 mm copper pipe) slide over the pipe instead of inside.

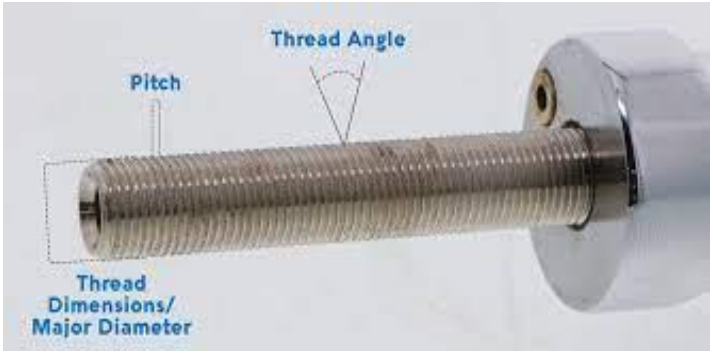
- **Heat Induction Bending: -** In the case of heat induction, a coil is placed around the pipe. The coil heats a section of the pipe to a temperature between 430 and 1,200 °C. The temperature depends on the material. The pipe passes through the coil at a gradual rate while a bending force is mechanically applied to the pipe. The pipe is then quenched with either air or water spray. The products thus obtained are generally of high quality but cost significantly more to produce.

- **Sand Packing Hot-Slab Bending: -** In the sand packing process the pipe is filled with fine sand and the ends are capped. The pipe is then heated in a furnace to 870 C or higher. The pipe is then placed on a slab with pins set in it. The pipe is then bent around the pins using a winch, crane, or some other mechanical force. The sand in the pipe minimizes distortion in the pipe cross section. It is an old process but one that hasn't really been improved on for its flexibility when it comes to unique applications, and so is still in common use.

- **Heat Bending Plastic Pipes: -**Bending of plastic pipes may be desirable under certain conditions where long radius bends and unusual configurations are required. It is possible to bend various sizes and wall thicknesses of rigid PVC-U, PVC-C and ABS pipe using heat bending techniques for long-radius sweeps for conduit and flow conditions. Irregular angles and U-bends for thermal compensation, and offsets in congested areas can be successfully achieved.

2.13 Pipe Threading: - A pipe thread is a spiral ridge on the end of a pipe that enables pipes to be joined together. For male fittings, pipe thread appears on the outer diameter of the pipe; if female, the pipe thread appears on the inner diameter. By rotating a male pipe end into a female pipe thread, the two fittings become joined.





The following steps should be considered in process of pipe threading: -

1. Secure the pipe firmly in a vise.

2. Put on work gloves and safety glasses.

3. Cut and ream the pipe if you need to make it a different length.

4. Choose a die head based on the pipe's diameter.

5. Attach the die head to a ratcheting pipe threaded handle.

6. Lubricate the end of the pipe with threading oil.

7 Place the die head onto the end of the pipe.

8. Ratchet the handle while applying pressure to the die head to start cutting.

2.14 PIPE JOINTS: - Pipe joints are connected to any piping system because it is not possible for a pipe network to have a constant length of pipe. These joints can make or break a pipeline system based on durability due to the technology used to make the joint.

Different pipe materials are used in the pipeline industry depending on the requirement and the type of products that will be conveyed through the pipes.

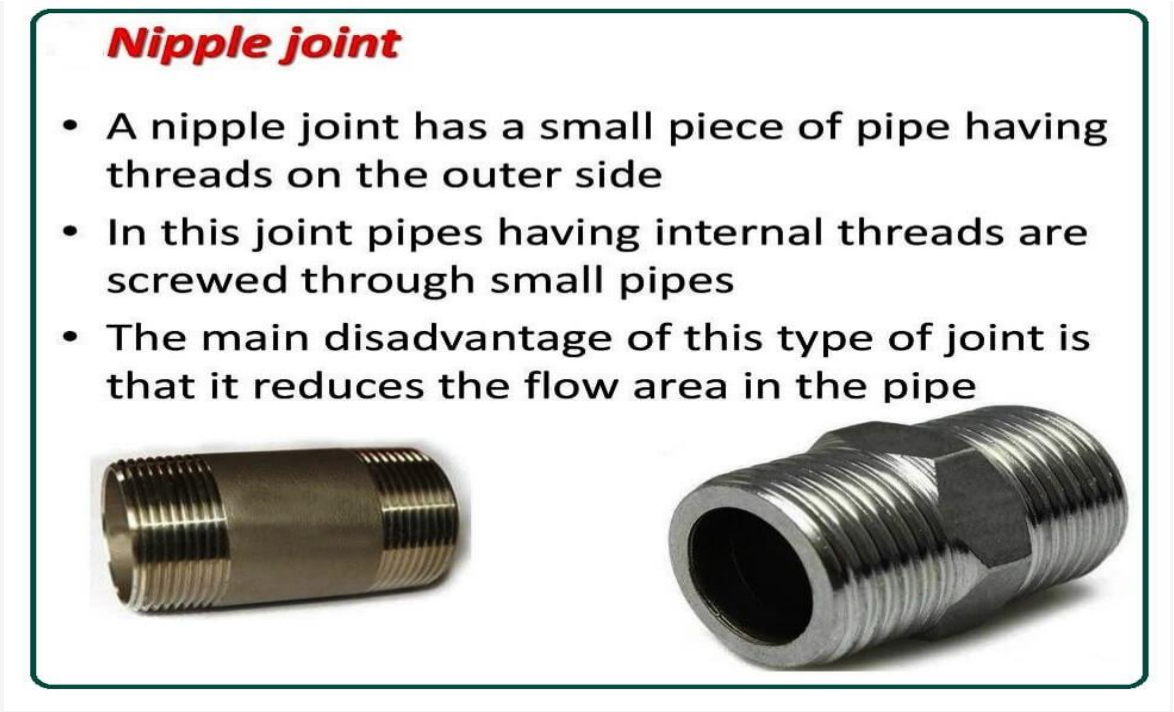
- **Types of Pipe Joints:-** Pipes are usually connected to the vessels from which they transport fluids. Since the length of the pipes available is limited, the pipes' different lengths have to correspond to a particular installation.
  Different forms of pipe joints are used in practice, but the most common are discussed below.

- **Seven types of pipe joints used in the plumbing system are as follows**.
  1. Socket or a Coupler Joint.
  2. Nipple Joint.
  3. Union Joint.
  4. Spigot and Socket Joint.
  5. Expansion Joint.
  6. Flanged Joint.
  7. Hydraulic Pipe Joint.

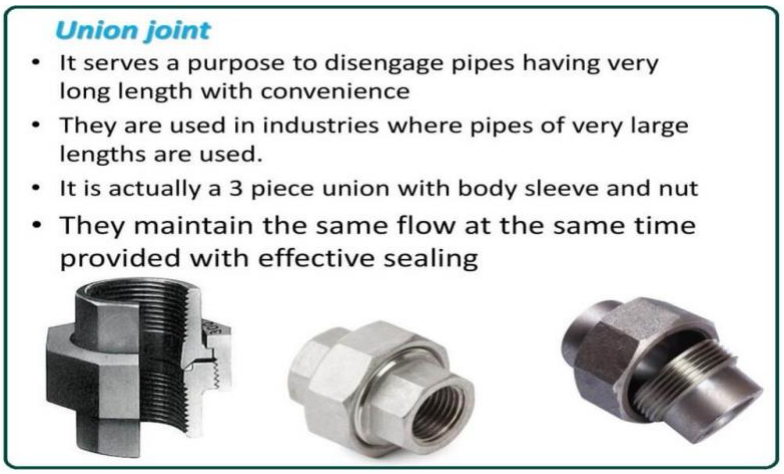
1. **Socket or a Coupler Joint**- The most common method of connecting to a pipe is through a socket or coupler. A socket is a smalls piece of pipe thread. It malfunctions halfway at the thread end of one pipe and the remaining half of the socket in the other pipe. Prevent leakages, jute or hemp

wound around the thread at the end of each pipe. Such joint is mostly used for low-pressure water-carrying pipes and where size aggregates are most essential.

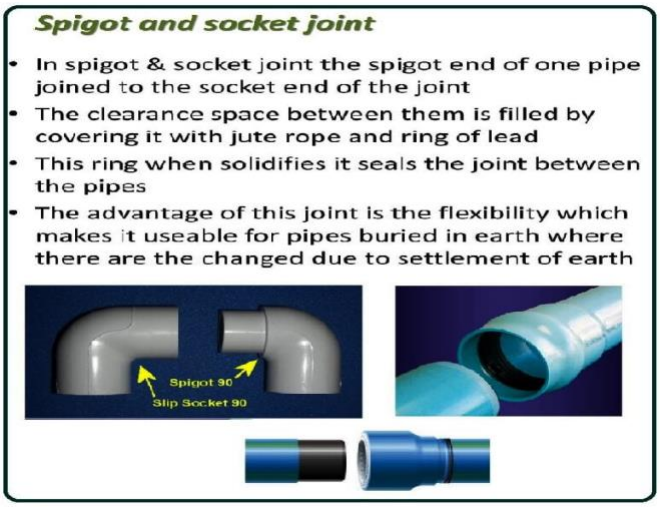
2. Nipple Joint-



3. **Union Joint: -** To separate the pipes joining the socket, it is necessary to unheard the pipe from one end. This is sometimes inconvenient when the pipe is long. The union joint facilitates the pipe separation by simply opening a coupler nut.



4. Spigot and Socket Joint: -

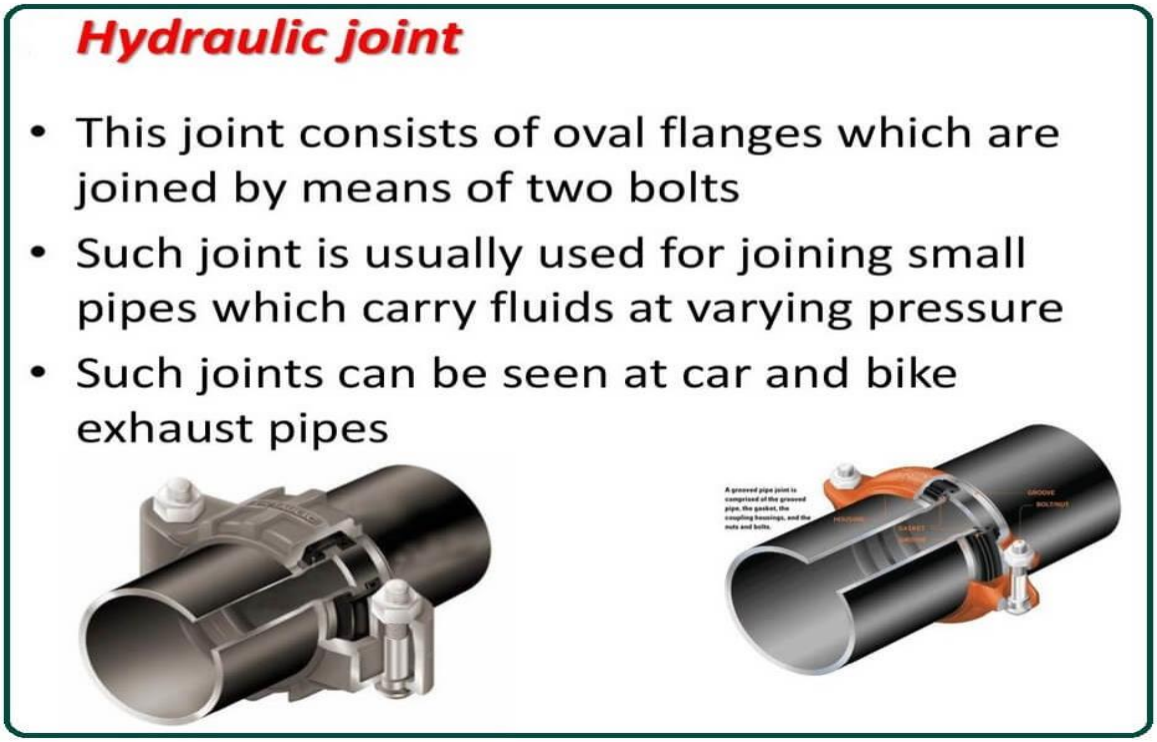


5. Expansion Joint: - Pipes carrying steam at high pressures usually connect via expansion joints. These joints are used in steam pipes to expand and contract pipelines due to temperature changes. Allow for a change in length; steams pipes are not tightly closed but supported on rollers.

Rollers can be arranged on wall brackets, hangers, or floor stands. Extension bends are useful in long pipelines. These pipe bends will flow in either direction and easily adjust themselves to the actual pipe's small movements to which they are connected.

6. **Flanged Joint:** -It is one of the joints of the most widely used pipes. A flanged joint pipe or loose flanges can be made with integral flanges welded or screwed—two cast-iron pipes with integral flanges at their ends. The flanges are connected via bolts. Flanges have been standardized for pressures up to 2 n / mm2. The flange faces are machined to ensure the correct alignment of the pipe. The joint can be made leak-proof by placing a gasket of soft material, rubber, or canvas between the flanges. Flanges are made thicker than pipe walls for strength.

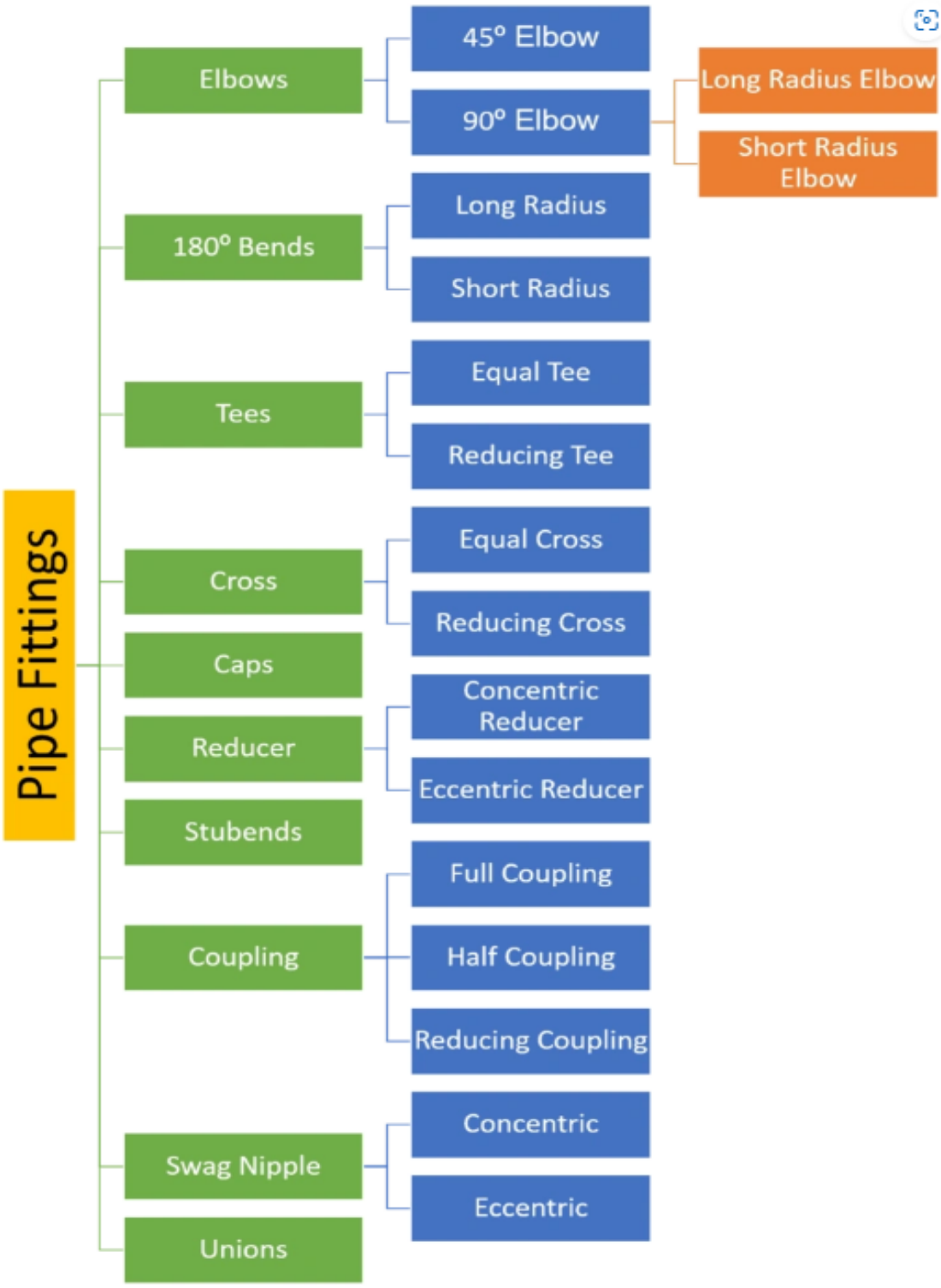
7. Hydraulic Pipe Joint: -



2.15 Pipe Fittings:-Pipe Fittings are a Piping component that helps in changing the direction of the flow, such as elbows and tees. Changes the size of the pipe such as reducers, reducing tees. Connect different components such as couplings and stop the flows such as Caps.

- **There are different types of pipe fitting used in piping work are listed below.**

1. Elbow
2. Tee
3. Reducer
4. Union
5. Coupling
6. Adapters
7. Olet (Weldolet, Sockolet, Elbowlet, Thredolet, Nipolet, Letrolet, Swepolet)
8. Valve
9. Cross
10. Cap
11. Swage Nipple
12. Plug
13. Bush
14. Expansion Joint
15. Steam Traps
16. Long Radius Bend
17. Flanges


Pipe Fittings
Elbows
45° Elbow
90° Elbow
Long Radius Elbow
Short Radius Elbow
180° Bends
Long Radius
Short Radius
Tees
Equal Tee
Reducing Tee
Cross
Equal Cross
Reducing Cross
Caps
Reducer
Concentric Reducer
Eccentric Reducer
Stubends
Coupling
Full Coupling
Half Coupling
Reducing Coupling
Swag Nipple
Concentric
Eccentric
Unions

2.16 Alignment of Pipe: - Generally, pipe alignment clamps are available for all the following purposes: To align and reform the mating side of the weld joint.To align and reform both sides of the weld joint. To align and reform pipes, tubes, elbows, tees, flanges, and other fittings. To hold pipe ends against a consumable welding insert.

2.17 Branching of pipes: - Branching pipes consist of number of pipes which are attached between the tanks to make the fluids flow from one pipe to other pipes that are branched together. It can be one pipe connected between two tanks or the number of pipes attached to the number of tanks.

2.18 Guidelines and Safety Precautions in pipe fitting: -

1. Bending procedures must be conducted in a well-ventilated area, using protective clothing (safety glasses, gloves, apron etc.) to prevent damage or injury.
2. Do not expose pipe to open flames or excessive temperatures.
3. Bends greater than 30° require internal pipe support to prevent distortion.
4. Common methods used to provide internal support to the pipe during the bending process include using a filling medium such as fine sand or perlite (cat litter), or inserting a coiled spring into the pipe, or in some cases providing internal pressure.
5. Compact filling medium prior to bending as much as possible to remove any air pockets prior to heating.
6. The pipe ends should be capped or plugged.
7. Minimum radius at bend should not be less than 5 times the pipe outside diameter to prevent kinking. Calculate required length of bend based on angle needed and heat this entire area uniformly.
8. Avoid overheating.
9. After the bend is completed, cool the bend with water to "set" the pipe at the desired angle.
10. Once the bend is formed and cooled, the filling medium is emptied from the pipe and any remaining particles can be easily removed by rinsing with water.
11. To provide fabrication consistency, standard pipe bending forms which provide the required radius or plywood jigs can be used.
12. Due to the recovery characteristics of the material, the pipe should be bent slightly beyond the desired radius and allowed to spring back to the required angle once uniformly heated at the correct temperature

EXERCISE

A. FILL IN THE BLANKS:-

1. The conduit through which water flows is called **pipe.**
2. The process of supplying water to the consumer is called as **water distribution**.
3. **Bell and Spigot** joint is mostly provided for cast iron pipes.
4. **Flanged joint** is used cast iron and steel pipes.
5. **Cast iron** pipes coated with Zinc or called galvanized iron pipes.
6. G.I pipes are **easy** to join.
7. **A.C** pipes are made of asbestos fibers and cement
8. What is the full form of HDPE **High density polyethylene pipes**
9. L.D.P.E stands for **Low density polyethylene pipes**.
10. P.V.C pipes are manufactured using **polyvinyl chloride.**
11. C.L pipes are manufactured using **grey cast iron.**
12. When a pipe is cut, a large ridge is left on the inside of pipe. It is called as **burrs.**

B. Short Answer Types Questions:

1. Define Pipe.
2. Define G.I pipe.
3. Define Union.
4. Define Die stock.
5. Define Pipe joint.
6. Define Collar.
7. Define Reducer.
8. Define Nipple.
9. Define Offset

.

C. Long Answer Types Questions:

1. Name the different type of pipe used in conveyance of water.
2. Describe the advantage and disadvantage of steel pipes.
3. Describe the advantage and disadvantage of cast iron pipes.
4. Explain the manufacturing of cast iron pipe.
5. Describe the advantage and disadvantage of asbestos cement pipes
6. Explain the advantage and disadvantage of P.V.C pipes.
7. Give the advantage and disadvantage of HDPE pipes.
8. Describe the advantage and disadvantage of Plastic pipes.
9. Explain the process of pipe bending.

UNIT-3
Water Supply System

3.1 Sources of water: - Source water refers to bodies of water (such as rivers, streams, lakes, reservoirs, springs, and ground water) that provide water to public drinking-water supplies and private wells. Water sources can include: Surface water (for example, a lake, river, or reservoir) Ground water (for example, an aquifer)

3.1.1 Surface water: - is any body of water found on the Earth's surface, including both the saltwater in the ocean and the freshwater in rivers, streams, and lakes. A body of surface water can persist all year long or for only part of the year.

3.1.2 Sub Surface water: - Groundwater, water that occurs below the surface of Earth, where it occupies all or part of the void spaces in soils or geologic strata. It is also called subsurface.

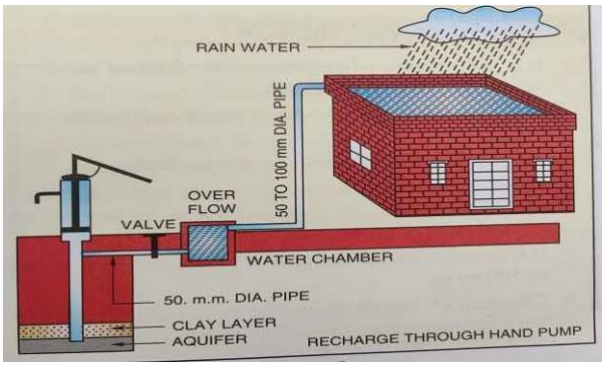
3.2 Rain Water Harvesting: - Rain water harvesting is collection and storage of rain water that runs off from roof tops, parks, roads, open grounds, etc. This water runoff can be either stored or recharged into the ground water.

Or

Rain water harvesting is a technique of collection and storage of rainwater into natural reservoirs or tanks, or the infiltration of surface water into subsurface aquifers (before it is lost as surface runoff).

Rainwater harvesting systems consists of the following components:

1. Catchment- Used to collect and store the captured rainwater.
2. Conveyance system – It is used to transport the harvested water from the catchment to the recharge zone.
3. Flush- It is used to flush out the first spell of rain.
4. Filter – Used for filtering the collected rainwater and removing pollutants.
5. Tanks and the recharge structures: Used to store the filtered water which is ready to use.



- **Advantages of Rainwater Harvesting: -** The benefits of the rainwater harvesting system are listed below.

1. Less cost.
2. Helps in reducing the water bill.
3. Decreases the demand for water.
4. Reduces the need for imported water.
5. Promotes both water and energy conservation.
6. Improves the quality and quantity of groundwater.
7. Does not require a filtration system for landscape irrigation.
8. This technology is relatively simple, easy to install and operate.
9. It reduces soil erosion, storm water runoff, flooding, and pollution of surface water with fertilizers, pesticides, metals and other sediments.
10. It is an excellent source of water for landscape irrigation with no chemicals, dissolved salts and free from all minerals.

- **Disadvantages of Rainwater Harvesting:-** In addition to the great advantages, the rainwater harvesting system has a few disadvantages like unpredictable rainfall, unavailability of the proper storage system, etc.

1. Regular maintenance is required.
2. Requires some technical skills for installation.
3. Limited and no rainfall can limit the supply of rainwater.
4. If not installed correctly, it may attract mosquitoes and other waterborne diseases.
5. One of the significant drawbacks of the rainwater harvesting system is storage limits.

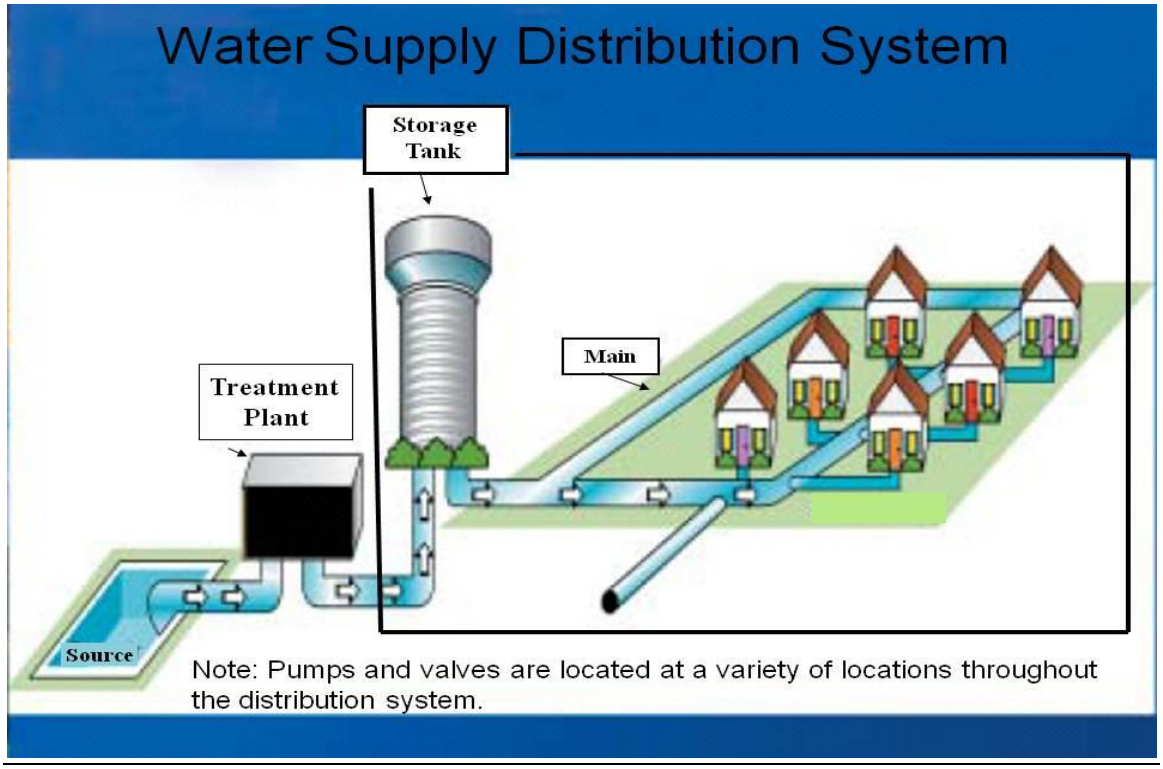
Methods of rainwater harvesting:-

The different methods of rainwater harvesting include:

1. **Rooftop rainwater harvesting –** The rooftop becomes the catchments, and the rainwater from the building and houses are collected. The components of the rooftop rainwater harvesting are:
    2. First, flush.
    3. Transportation.
    4. Catchment.
    5. Filter.

2. **Surface runoff harvesting –** It is the system that collects rainwater, which flows away as surface runoff. The runoff rainwater is caught and used to recharge aquifers by adopting appropriate techniques.

3.3 Water Supply System in a Town: - One way water is supplied to town residents is for the water department pump water from a reservoir, river, or well into a water tower, which often sits on high points in the town. Using gravity, the water flows through pipes all the way to the last house in a subdivision.



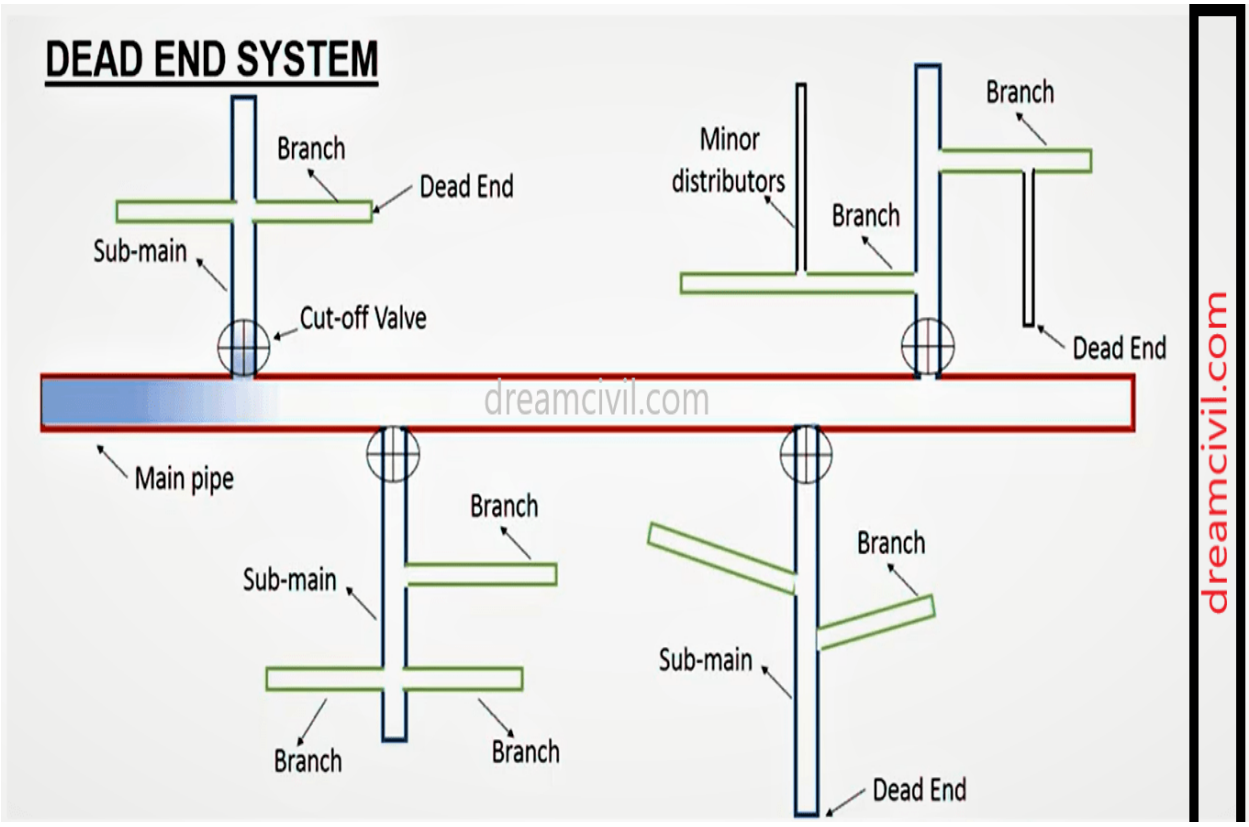
3.3.1 Water Distribution System:- A water distribution system is a part of water supply network with components that carry potable water from a centralized treatment plant or wells to consumers to satisfy residential, commercial, industrial and fire fighting requirements.

Types of a water distribution system:-

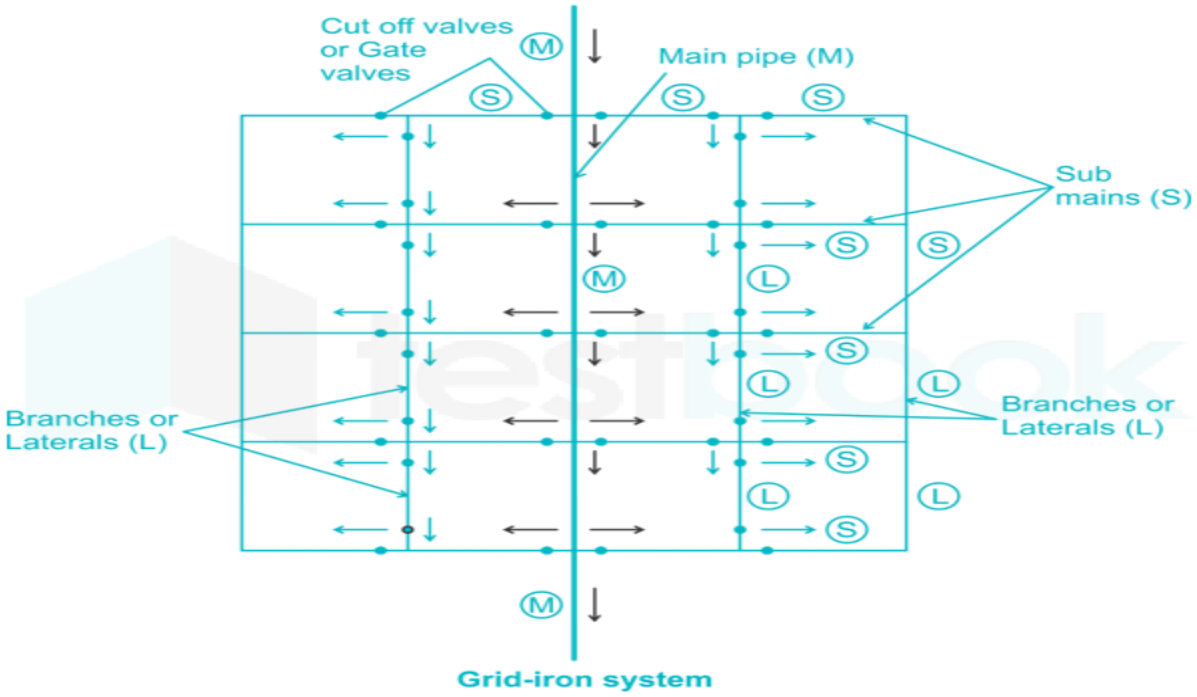
The following are four major types of a water distribution system

1. Dead-end or Tree Distribution system.
2. Gridiron Distribution System.
3. Circular or ring Distribution System.
4. Radial Distribution System.

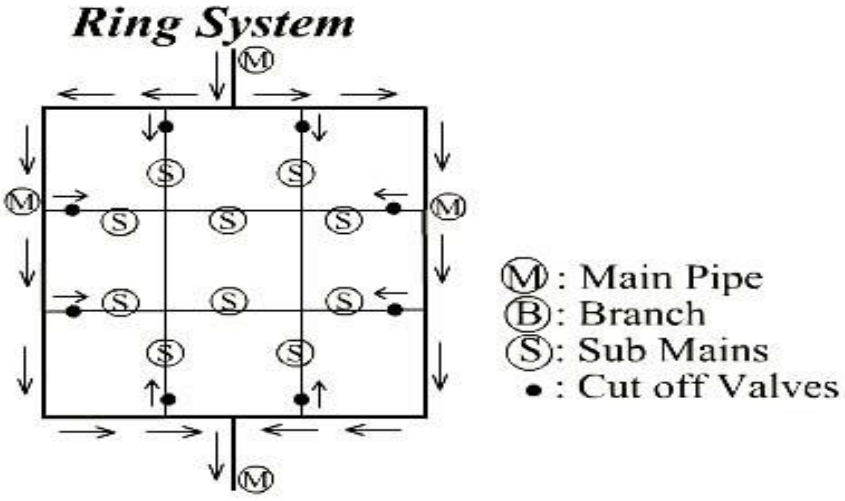
1. **Dead-end or Tree Distribution system: -** In the dead-end system (also called tree system), one main pipeline runs through the centre of the populated area and sub-mains branch off from both sides. The sub-mains divide into several branch lines from which service connections are provided.



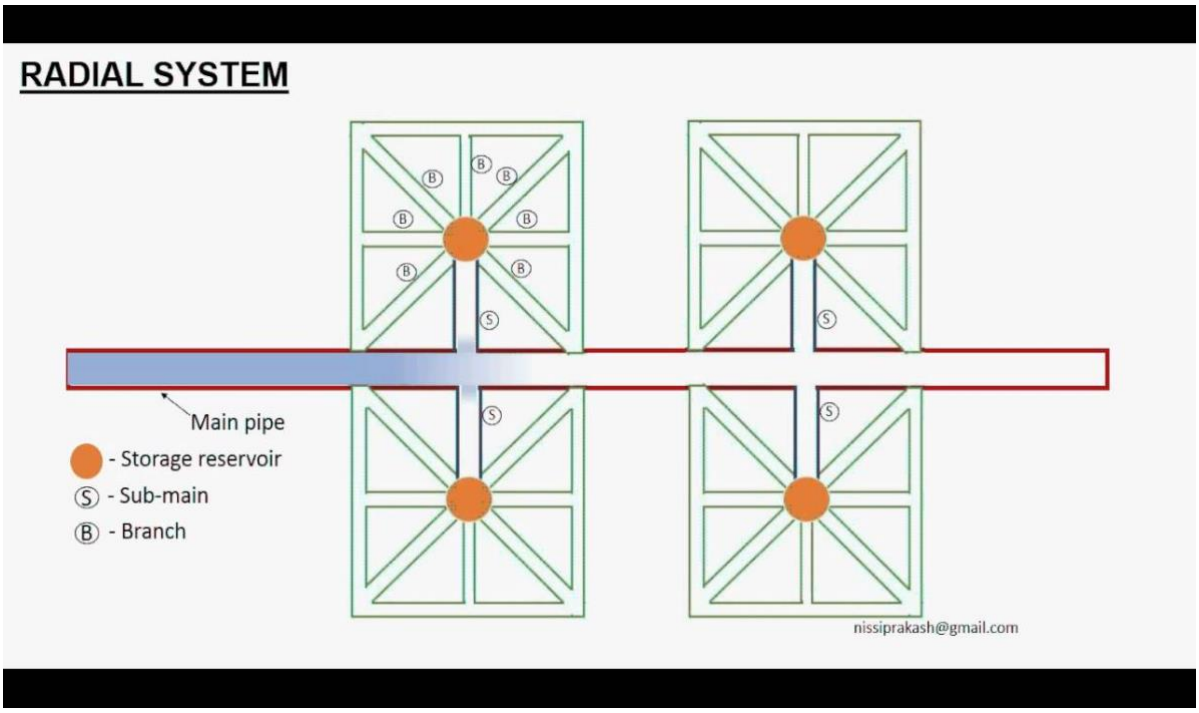
2. **Gridiron Distribution System: -** In this, the main supply lines run through the center of the building, and sub mains branch off in perpendicular directions. The branch interconnects the sub-mains. The distinguishing features of this system are that all types of pipes are interconnected and there are no dead ends.



3. **Circular or ring Distribution System: -** In these types of water distribution system, the supply main forms a ring around the area. The branch pipes are connected cross-wise to the mains and also to each other.



4. **Radial Distribution System: -** Radial system is quite opposite to the ring system. In this system, whole area is divided into small distribution districts or zones and an individual distribution reservoir is provided for each distribution zone. The reservoir provided is generally of elevated type.



3.4 Distribution reservoirs: - Distribution reservoirs, also called service reservoirs, are the storage reservoirs, which store the treated water for supplying water during emergencies (such as during fires, repairs, etc.) and also to help in absorbing the hourly fluctuations in the normal water demand.

In the pumping water distribution system, water is supplied to the consumers with the help of pumps. Some extra pumps are also installed for emergency causes like fire hazards, peak water demand, etc. This method is suitable if the source is at a lower elevation than the target community.

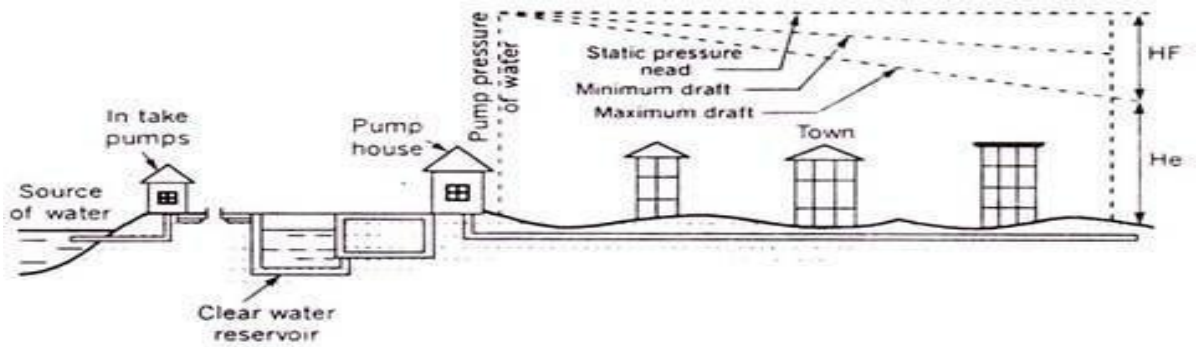


Fig. 18.2. Pumping System of Distribution.

3.4.1 Pump: - The term pump refers to all centrifugal pumps which transport drinking or service water either directly to a supply network or through long-distance pipes to a supply area.

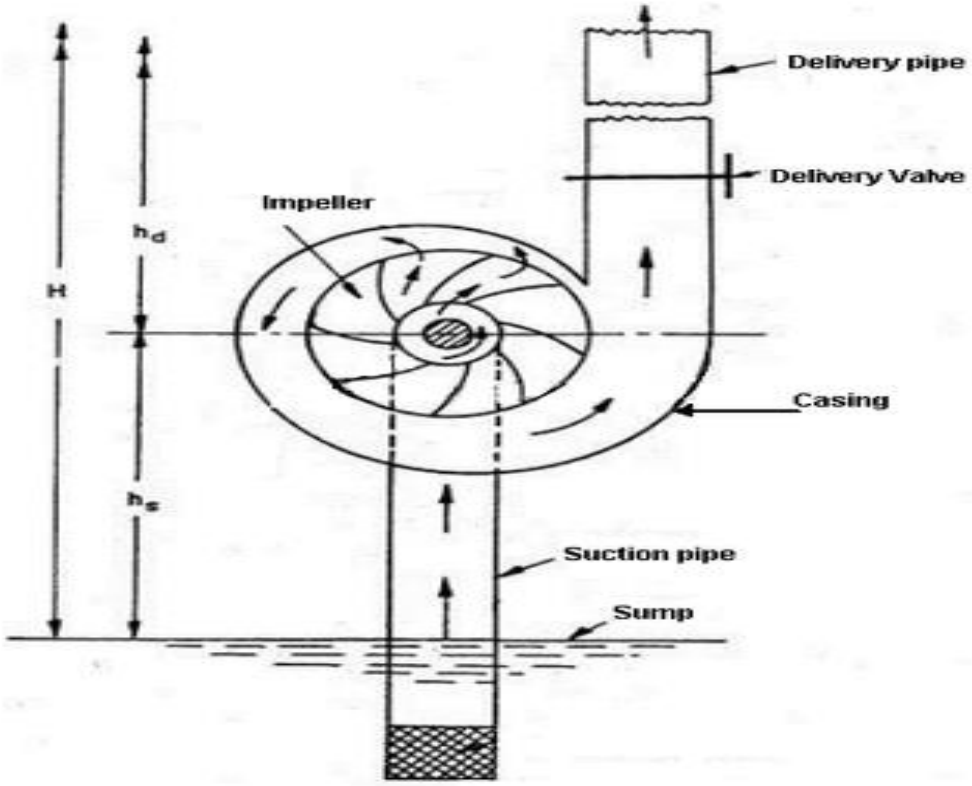
Mainly two types of pumps are used in water distribution:-

1. Centrifugal pumps.
2. Submersible pumps.

1. **Centrifugal pumps: -** A centrifugal pump is a mechanical device designed to move a fluid by means of the transfer of rotational energy from one or more driven rotors, called impellers. Fluid enters the rapidly rotating impeller along its axis and is cast out by centrifugal force along its circumference through the impeller's vane tips.

   Centrifugal pumps are used to transport fluids by the conversion of rotational kinetic energy to the hydrodynamic energy of the fluid flow. The rotational energy typically comes from an engine or electric motor.

   The working principle of a centrifugal pump is based on forced vortex flow. The forced vortex flow means that when a certain mass of fluid rotates by an external force (leading to an external torque), there is an increase in the pressure head of the liquid.

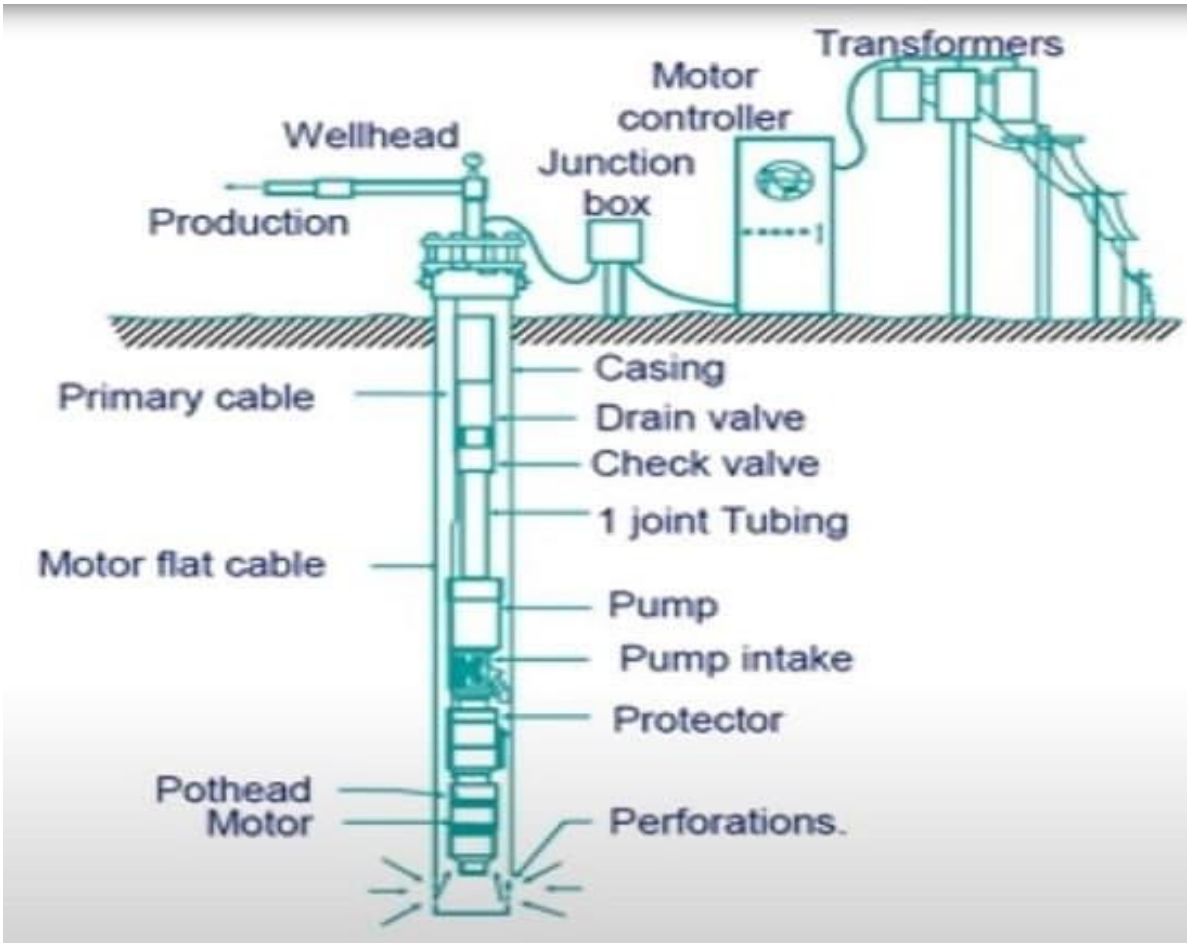


2. **Submersible pumps: -**Submersible pumps are centrifugal pumps whose hydraulic components (pump casing, impeller, and diffuser element) are flooded by the fluid

handled. Usually, this type of pump is not fitted with a suction line. A submersible pump whose motor is arranged above floor is referred to as a vertical shaft submersible pump.

Submersible pumps are often used to pump excess water from work sites or flooded basements in construction sites. They can also be used to pump slurries. Submersible pumps can be used in inland or offshore oil wells to pump oil from the ground to treatment and holding facilities above ground.

The working principle of an electric submersible pumps are multistage centrifugal pumps operating in a vertical position. Liquids, accelerated by the impeller, lose their kinetic energy in the diffuser, where a conversion of kinetic to pressure energy takes place.



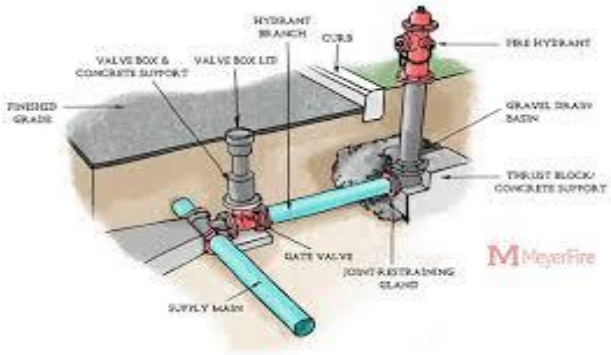
3.4.2 Valves: -A valve is **a type of fitting that allows for regulation, control, and direction of fluids passing through a pipe**. Valves are commonly used to direct flow, shut off water access, prevent backflow, and adjust water pressure within a system.

- Combi valves, gate valves and butterfly valves are key components of the water distribution system. Hawle valves are suitable for underground installation.

- Common valve types include Ball, Butterfly, Check, Diaphragm, Gate, Globe, Knife Gate, Parallel Slide, Pinch, Piston, Plug, Sluice, etc.

3.4.3 Fire hydrants: - A fire hydrant, waterplug, or firecock is a connection point by which firefighters can tap into a water supply.

Purposes of fire hydrants are extracting water from pipelines and water distribution systems. In the event of a fire outbreak, a fire hydrant can assure fast water supply. The connections to the pipes are tapped with so-called hydrant wrenches and hydrant standpipes and are further connected to the fire trucks.



3.5 Storage of water in buildings: -Reservoirs and tanks for storage of water shall be constructed of reinforced concrete, brick masonry, Ferro cement, mild steel, stainless steel, plastic, or GRP (Glass reinforced panels).

Water storage tanks are generally either pressure tanks or atmospheric tanks. Point-of-use applications, like reverse osmosis storage tanks, usually implement pressure tanks. Outdoor applications or large scale municipal water storage operations usually use atmospheric tanks.

- **Types of tanks: -** Depending upon the capacity and requirements the tanks are classified in to three main types related to the **underground water tank, elevated water tank and resisting on the ground.** One of the best water tanks in the market are plastic water tanks. These tanks come in various capacities such as 500-litre, 1,000-litre, 5,000-litre etc. They usually come in cylindrical, square and rectangular shapes.

- **Laying of water supply pipe lines:-** The water service pipe should be laid between 750mm-1350mm below ground, on a bed of sand, ducted and insulated as it enters the property and should be fitted with an internal stop tap and a compression fitted cap end. Its most commonly laid on private land up to the highway boundary. **Open-trench pipe-laying** is the most common method. To start with, a trench is excavated along the planned pipeline route. If the in-situ soil does not offer a suitable pipe bed, the trench is deepened and bedded. The pipes can then be lowered into the trench as a welded pipe string.

EXERCISE

A. FILL IN THE BLANKS:-

1. **Ventilator** is provided in elevated storage reservoirs for circulation of air.
2. Displacement pumps are **reciprocating and rotary.**
3. Impellers are provided in **centrifugal Pump.**
4. Dual system means combined **gravity and pumping**.
5. **Surface reservoir** are also called non elevated reservoir
6. Safety valve is also called pressure **relief valve.**
7. Air valve is placed on both sides of **gate valve.**
8. Pressure relief valve is also called **safety valve.**
9. Check valve is also called **reflux valve** or **non return valve.**
10. Cost of laying water pips is **more** in grid iron method.

B. Short answer types questions:

1. Define Lake and Pond.
2. Definer Well.
3. Define Tube well.
4. Define Pump.
5. Define Fire hydrants.
6. Define Continuous system of water supply.
7. Define Surface source of water.
8. Define Water Distribution system.
9. Define spring.
10. Define Infiltration galleries.

C. Long answer type question:

.

1. What are the various sources of water supply schemes?
2. What is rain water harvesting? Explain
3. Write Note on Distribution Reservoirs
4. Explain the system of water supply
5. Give the advantages and disadvantages of grid iron system of distribution of water supply
6. Explain the advantages and disadvantages of ring and circular system of distribution of water supply
7. Write in detail about fire hydrants
8. Explain centrifugal pump and reciprocating pump.

Unit -IV DOMESTIC DRAINAGE

4.1 Drainage System-A system provided to smooth and easy run-off the domestic water called Drainage system.

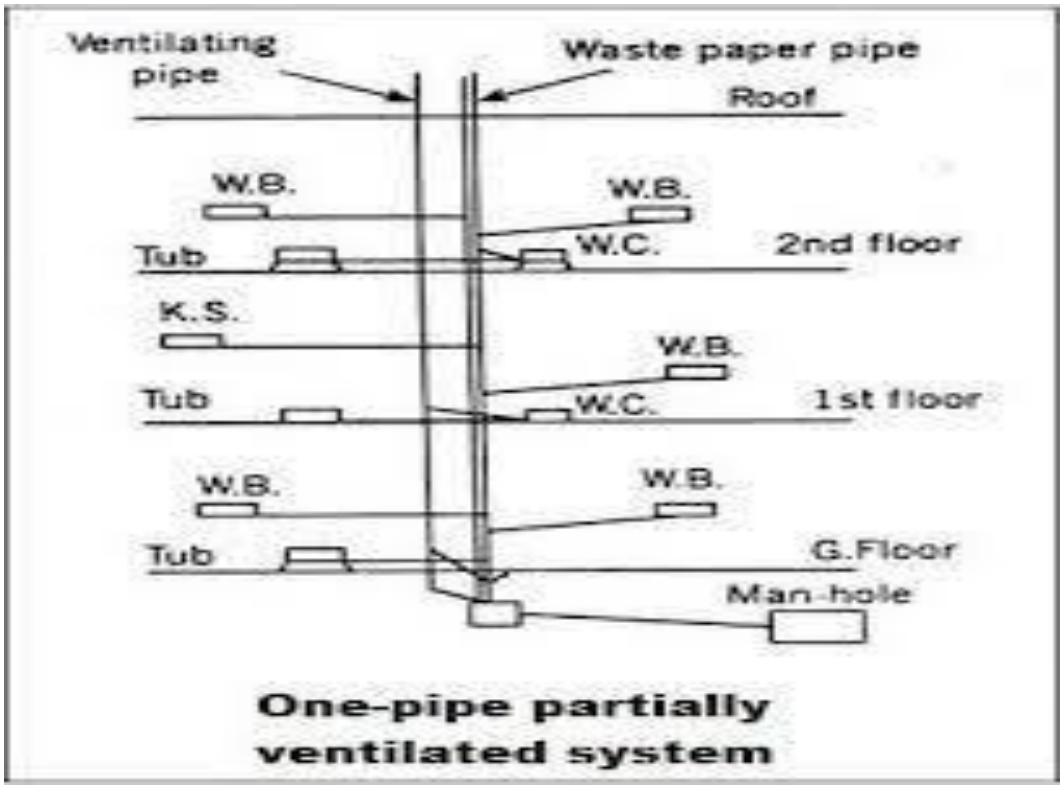
4.1.1 One Pipe System-The system of draining-off the domestic water using a single pipe for both kitchen waste and sewage waste called one pipe system.

Advantages-

- Only one pipe is used
- Economical
- Suitable for congested areas.

Disadvantages-

- Both water get mixed.
- Difficulty in sewage treatment.



One-pipe partially ventilated system

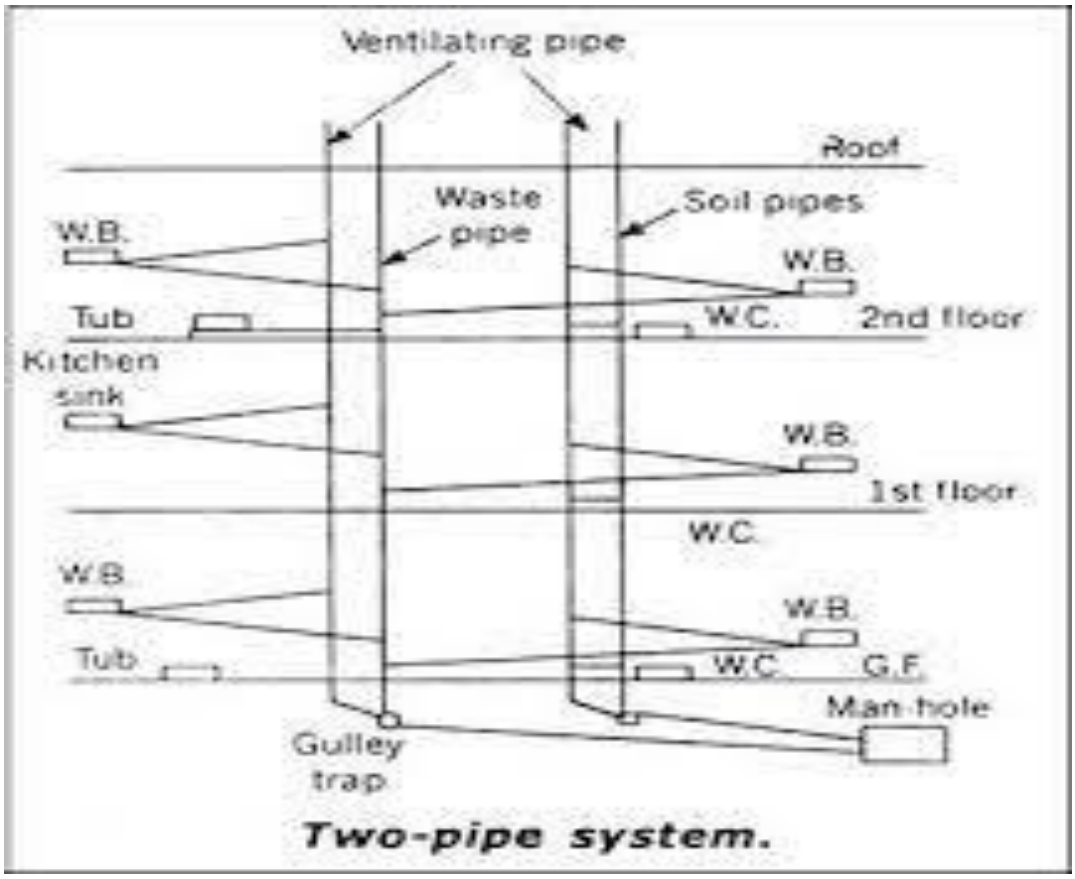
4.1.2 Two Pipe System-The system of water drainage in which two separate pipes are used for the disposal of kitchen waste and sewage waste known as two pipe system.

Advantages-

- Two separate pipes are used for both wastes
- No mixing done
- Easy and well handled

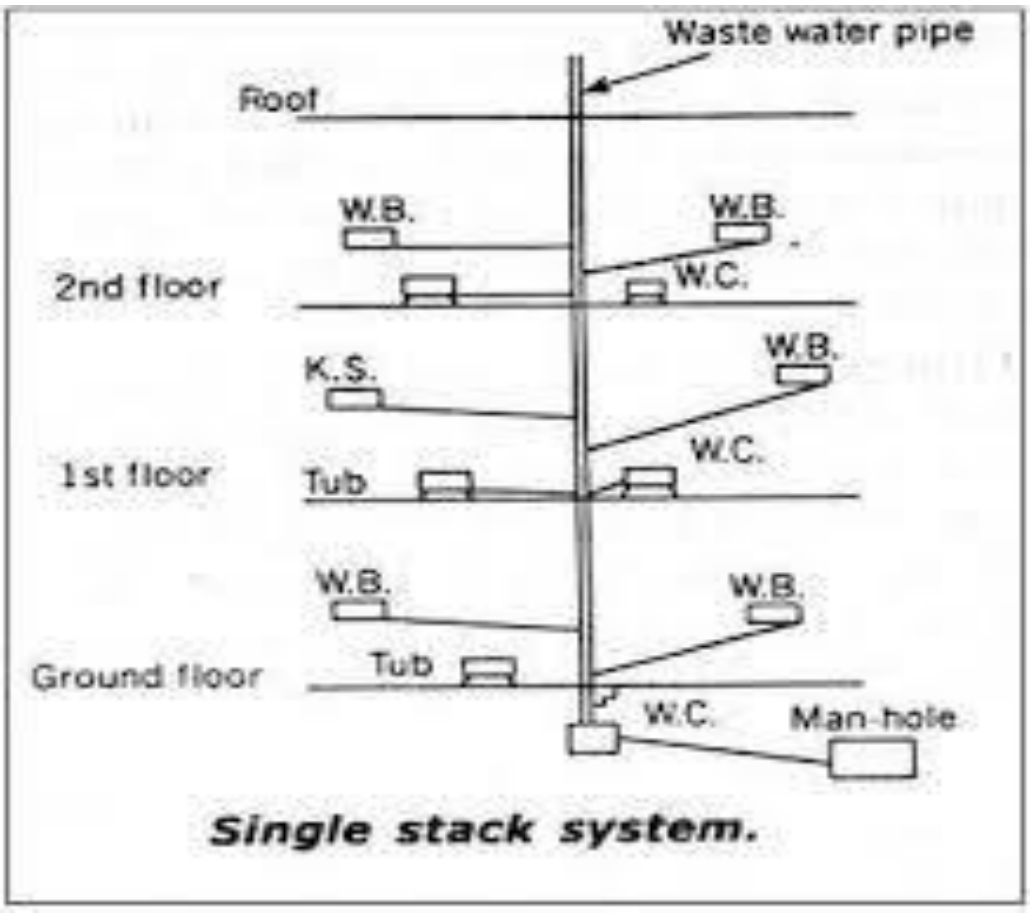
Disadvantages-

- Un Economical
- Not suitable for congested areas
- Extra workmanship.



Two-pipe system.

4.1.3 Single Stack System-This is the one simplest system, where wastewater from the baths, kitchens, sink etc. as well as sewage matter is discharged using a single pipe which is called S.W.P

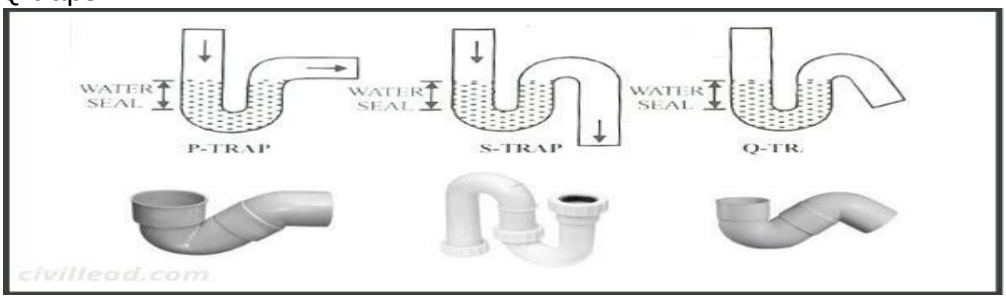


Single stack system.

4.2 Traps-These are the bands provided in drainage always full of water and prevent entry of foul smell and gases into the atmosphere.

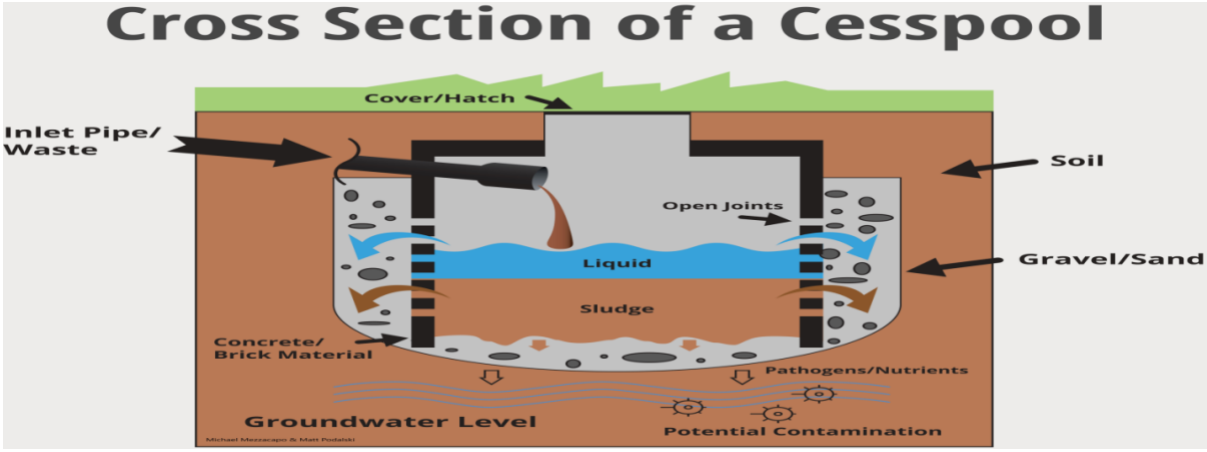
They are further classified as-

- P-traps
- Straps
- Q-traps



4.3 Cesspool-A simple collection point provided for the collecting wastewater from the buildings.

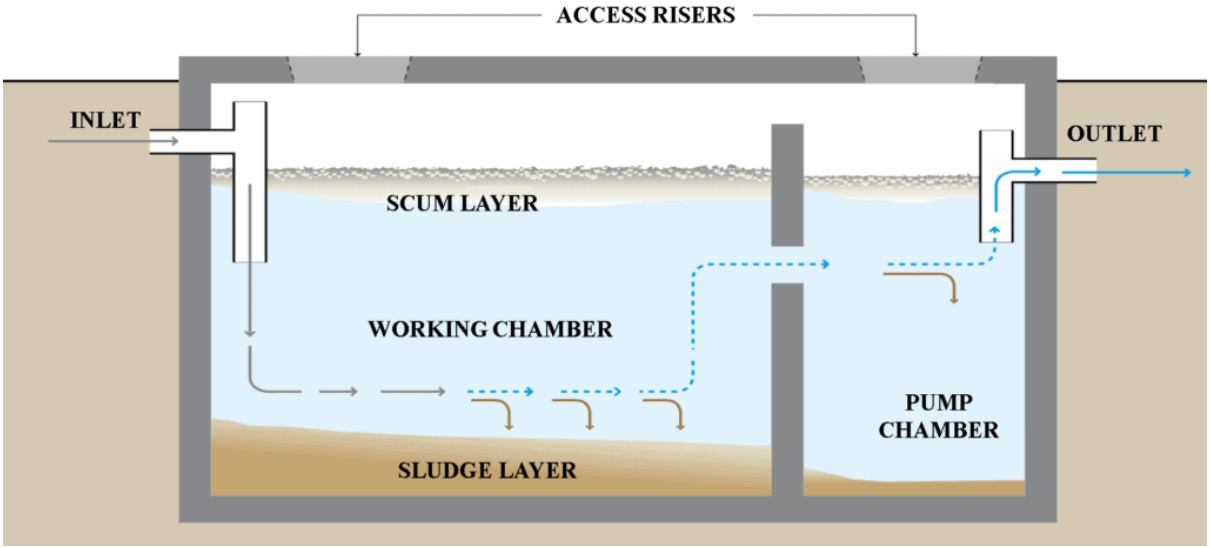
These are located below the ground level and need be cleaning at regular intervals.



4.4 Septic Tank-It is a solid construction usually of masonry or concrete built below the ground level for collection of waste water and human wastes.

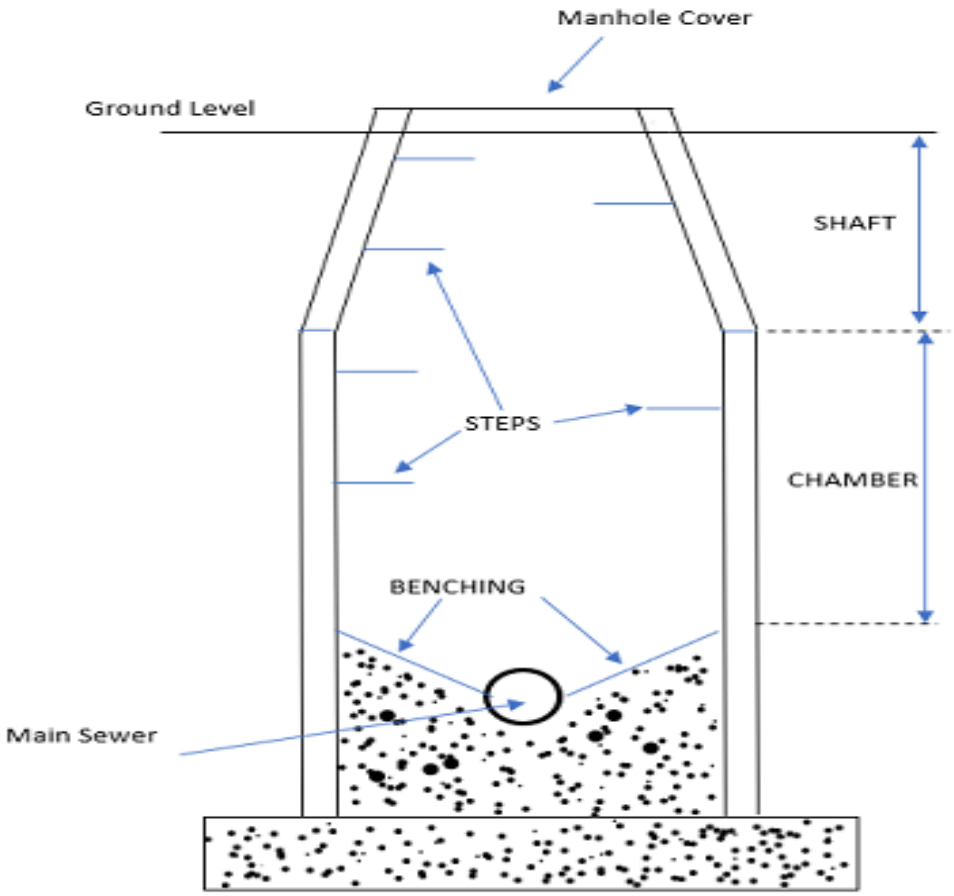
These tanks should not be located near the residential areas so as no issue i.e. foul smell etc. occurs.

It should be considered that their affluent should not be allow to flow as in open, it may too cause health problems.



4.5 Man Hole-It is defined as a opening constructed in sewers for the purpose of entering men into the sewers.

Generally, these openings are constructed at the junctions of main pipes and branch pipes at a interval of 50 to 200m.



4.6 Cleaning of Blocked Pipes and Drains-

There are following methods adopted to clear blocked pipes and drains-

- Boiling water
- Caustic cleaner
- Plunger
- Snake and CCTV
- Excavation
- Hydro-Jet

4.7 Lying of Sanitary and Sewer pipes- The lying of pipes and sewers are done in following steps-

1. General planning of the area and Map study
2. Fixing alignment of pipe-line

3. Excavation of trenches
4. Bedding of Trenches
5. Lowering of pipes towards trench bed
6. Lying of pipes into the trenches
7. Jointing of pipes
8. Testing of pipe through leakage and pressure test
9. Back-filling

4.8 Inspection and Testing of Pipes-Pipes plays a vital role in effective drainage and discharge of water. So be clear to the point it is very important to test or inspect the pipe system after lying done.

Test Performed-

4.8.1 Leakage Test-These is a simple test generally adopted for the small pipe works, where the pipes are tested by water flowing and deeply the joints are keep in view because generally leakage exposed from that portions.
When somewhere the leakage is detected, effective remedy is applied.

The maximum allowable leakage is terminated as Q=N*D SQRT(P)/3.3

4.8.2 Pressure Test-The pressure testing of pipe is done into parts. The pipe is divided into various sections.
One section is selected for testing between the two valves.

4.8.3 Straightness Test of Pipes-It is a common and easy test performed by placing a mirror at one end of the sewer and similarly a lamp at other.
If a pipeline is straight, then the full circle of light would be visible otherwise the appearance may be apparent.

4.8.4 Ball Test-In this type of test, usually a billiard ball is place at the high end of the pipe and is allow rolling through the pipe to the low end of the pipe.
If there are not obstructions and the pipe is well graded then the ball is caught and removed and in such situation, it is called the pipe passed the ball test.

4.9 Fixing accessories-There are following types of fittings done in plumbing-

- **Elbow-**To change angle or direction
- **Tee-**Generally T-like in shape
- **Couplings-**To join two different pipes together.
- **Caps-**To close the dead end
- **Valves-**To control and regulate the flow
- **Plugs-**To close an ending on pipe fitting
-

4.10 Problems in Drainage and their Remedies-

The very common problems in drainage system are listed below-

1. **Blockage-**clogged drains, slow draining sinks etc.
   Solution-Cleaning of blocked pips, Excavation, snake and CCTV, plunger, hydro-jet etc.

2. **Cracks-**these are developed naturally due to high pressure and heavy loads.
   Solution-proper use, use of pipes with desired capacity, neglecting the use of rough pipes

3. **Leakage-**These problems generally occurs at pipe connection and joints.
   Solution-performing tests i.e. pressure test, leakage test etc. prior of backfilling.

4. **Root Instructions-**Generally plants and roots grown up into pipes in lack of proper cleaning of pipes and results in water logging, blockage etc.
   Solution-Proper cleaning of pipes, maintenance at regular intervals, frequent use.

EXERCISE

A. Fill in the blanks:-

1. When all waste in discharge to a single waste pipe the system is known as **single stack waste system.**

2. When a **water seal** is broken in a drainage system smell with escape back to the building.
3. The lowest point on the interior of a drain pipe or sewer where the liquid in deepest is called **invert.**
4. The minimum size trap for residential sink is **38mm.**
5. **Vitrified clay pipe** is the oldest material used for sewer line which is highly resistant to acid.
6. **Bituminous fibre sewage pipe** in the cheapest pipe which is light in weight.
7. In plumbing what does DWV means **drain waste vent.**
8. Drainage system works under **gravity.**

B. Short Answer Types Questions:

1. Define over pipe system
2. Define two pipe systems for drainage.
3. Define trap.
4. Define water seal.
5. Name the different types of trap.
6. Define gully trap.
7. Define intercepting trap.
8. Define cesspool
9. Define manhole.
10. Define drop manhole

C. Long Answer Types Questions:

1. What is the difference between two pipe system and one pipe system of drainage?
2. What are the advantages of one pipe system over two pipe system.
3. Define trap. How will you classify them?
4. What precautions should be taken to for prevention of breaking of seal?
5. Write a short note on cesspool.
6. What is septic tank and why it is provided.
7. What are the different stages of construction and lying of sewers?
8. Explain in brief stages various or laying sewer lines.
9. Define manhole. Where they are provided.
10. Explain the hydraulic or water test for sewer.
11. What points should be kept in mind while fixing accessories.
12. What are the various problems in drainage?

UNIT-V
SANITARY APPLIENCES

❖ **SANITARY APPLIENCES**

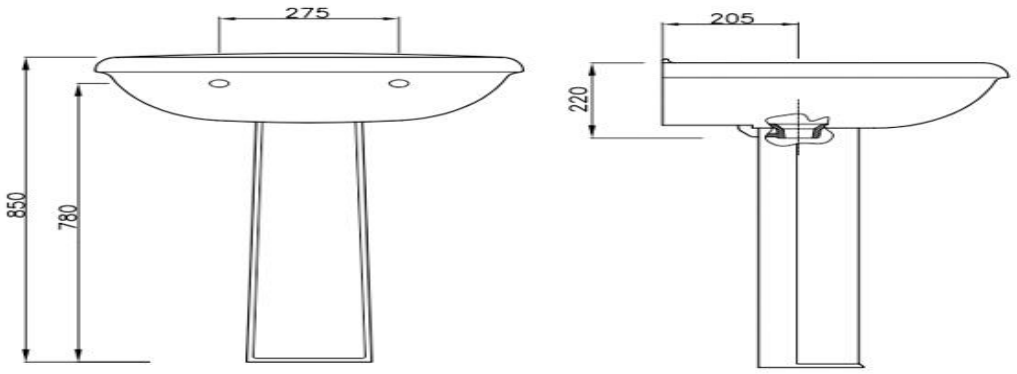
5.1 Flush Toilet:-It is water flushed plumbing fitting which generally designed to receive human excreta directly from the user. Or A flush toilet is a toilet that disposes of human waste by using the force of water to flush it through a drainpipe to another location for treatment, either nearby or at a communal facility, thus maintaining a separation between humans and their waste.

Requirements for flush toilet-

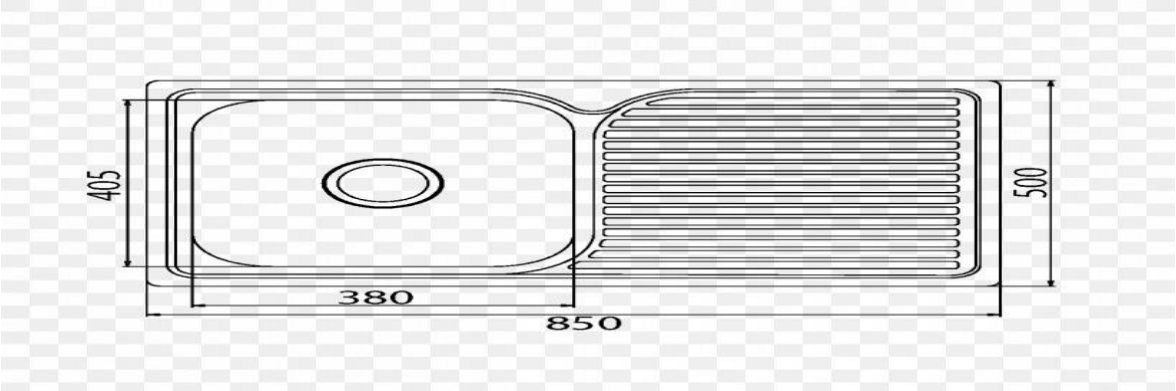
1. It should provide easy flushing.
2. It should be dust proof.
3. It should have good appearance.

5.2 Squat Toilet: - Squat toilet is a type of toilet which is used by squatting rather than sitting. These toilets mainly consist of a Pan and a Bowl at floor level these toilets also known as Indian Toilets.

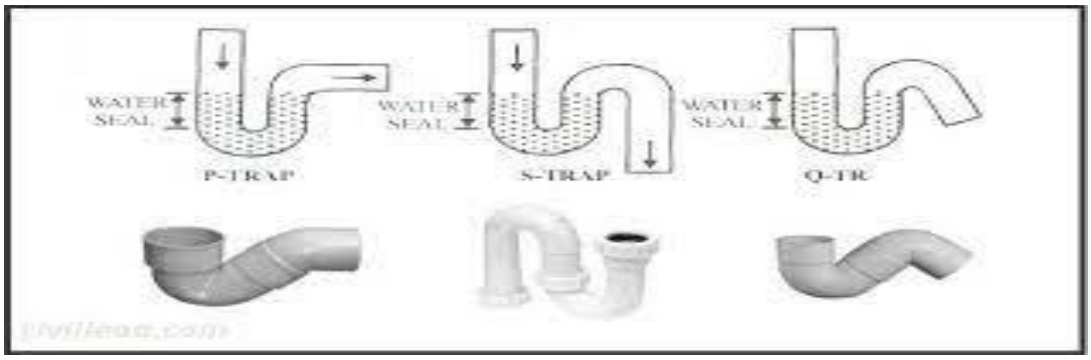
5.3 Wash Basin: - It is a basin provided for the purpose of washing hands, mouth etc. These basins are available in various forms. Pedestal type, Bracket type, Flat back type, Angle type.



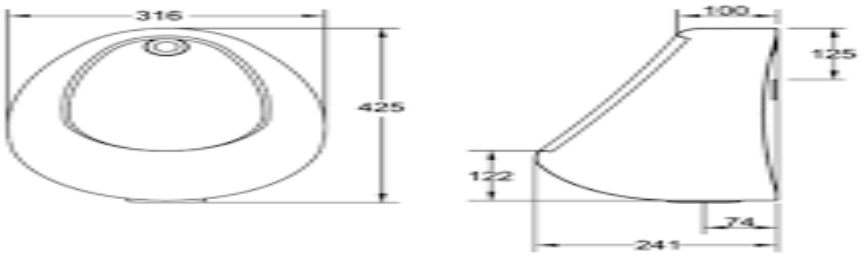
5.3 Sink:-It is a rectangular shallow receptacle generally used in kitchens, laboratories. Commonly made of stainless steel, fine clays etc.There is a circular waste hole for draining off waste and a slope towards that hole is also provided for easy flow off.



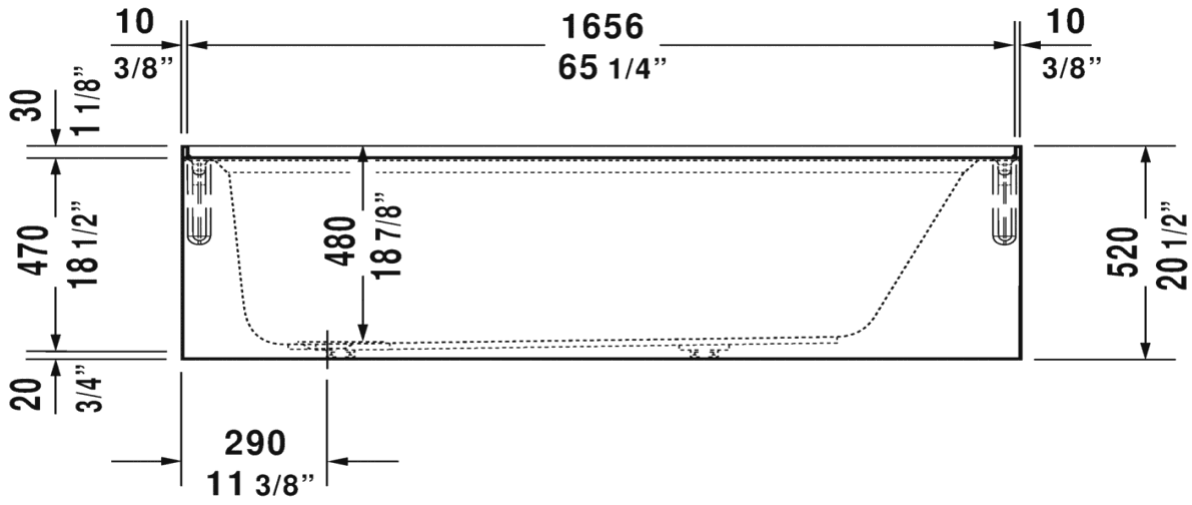
5.4 floor traps:-The traps provided at the floor of bath, kitchens etc. for the removal of waste water or surface wash etc. They are provided in various shapes-P-shape**,** S-shape**.** Q-shape.



5.5 Urinal:-This is a common arrangement provided for receiving human Urine. These are available in various size and patterns.



5.6 Bathtub: -A tub provided for bathing purpose is termed as Bath-Tub.
These are made up of various materials such as Marble, plastic, cast iron etc.
It may have parallel as well as tapering sides as per requirements.



5.7 Shower: -It is a piece of equipment used in modern technology now a day.It produces spray of water used to take Bath.It eventually gives the drops of water like rain drops.

5.8 Bidet: - A bidet is a sanitary appliance primarily designed to wash the excretory organs and sometimes may be used as foot bath. It supplies both hot and cold water.

5.9 Mixing tap:-When both hot and cold water are available, the faucets used in laboratories, bath-tub, bidets and kitchen sinks are to be provided of mixing type instead of having two separate units (for hot and cold water supply) and these taps are termed as mixing taps.They also permit to adjust the temperature of water as per the requirements.

5.10 Popup waste:-It is also known as pop up assembly. It is a type pf pipe fitting that joins a sink, basin and bidet to a waste pipe at the plug hole.

❖ **HEATING SYSTEM**

5.11 Heat Transfer: - Heat is transferred from one point to another point with or without the actual contact between two bodies. There are following three methods used to transfer heat from one to another;

A. Conduction- is a kind process generally adopted in case of solid bodies when there is a contact in between two bodies. Conduction is the movement of heat through a substance by collision of molecules.

B. Convection-is a way for transferring heat in solids and gases. It is done by physical movement of heated particles.

C. Thermal Radiation-It is a process adopted when there is no contact between two bodies because these processes do not need any contact between heat source and heating object.

5.12 Water Heater:- Hot water is need for various operations such as washing, bathing, cooking etc. in small houses as well as in professional apartments like hospitals, hotels etc.

The sanitary arrangement provided to make and supply the hot water for further use is termed as Water Heating System or Water Heater.

The fuel is generally used to create and distribute Heat Energy, but Electricity is considered the most convenient form of heat as it is clean, always available and supplies continues energy of heat.

5.12 Geyser: - Geyser is the most common appliances that are seen every household. It Help to get the hot water quickly. It is also used to store water for long period of time. Geysers consume less energy than other water heating appliances such as heating-rods etc.

5.13 Supply of Hot water to Domestic Building: - A Domestic Hot Water (DHW) System delivers hot water to fixtures used by people at the sink, shower, tub and any other appliance where water may contact humans. They typically work by delivering hot water through a centralized storage tank separate from water that may be used for steam or hydronic heating. It works by passing water through a copper pipe – usually coiled within a heat exchanger – that is heated either by an electric element or a gas burner. The water is immediately heated as it passes through and is sent directly to the water outlet.

There are **three types of domestic hot water system**. This first is a combo boiler system where the boiler directly heats the water on demand. The second is a gravity fed (open vent) hot water tank which is fed from a tank in the loft. The third is a pressurized hot water system.

5.14 Central heating system: - A central heating system has pipe work and radiators which are connected to a boiler. The boiler provides the heat and the pump moves heated water from the boiler through the pipe work to the radiators, and back to the boiler for reheating. It also provides hot water to the hot taps in your home. **Boilers and furnaces** are examples of central heating systems.

EXERCISE

A. FILL IN THE BLANKS:-

1. Heat flows from one point to other if there is **difference** in temperature.
2. Heat always moves from **higher** to lower temperature.

3. There are **three** modes of transfer of heat.
4. Construction occurs when two objects of different temperature are in **contact** with each other.
5. The **black** colour absorbed maximum energy on it as compared to other colour.

B. Short Answer Types Questions:

1. What do you mean by Flush Toilet Give their two Requirements-
2. What is Squat Toilet?
3. What do you know about wash Basin?
4. What is sink?
5. What do you mean by Urinal?
6. What do you know about Bath-Tub?
7. What is Bidet?
8. What do you mean by mixing tap?
9. What do you know about water heater
10. What is Geyser?

C. Short Answer Types Questions:

1. Explain about floor traps?
2. Describe about shower?
3. Explain about pop up waste?
4. Give details about Heat Transfer?
5. Explain about Supply of Hot water to Domestic Building?

❖