PLUMBING

- The art and science of creating and maintaining sanitary conditions in building used by humans.

- It is also defined as the art and science of installing, repairing and servicing the pipes, fixtures and appurtenances necessary for bringing in water supply and removing liquid and water-borne wastes;

PLUMBING

- the art and science of installing in buildings the pipes, fixtures and other appurtenances for bringing in the water supply and removing liquid and waterborne wastes. It includes the fixtures and fixture traps; the soil and waste pipes; vent pipes; the building drain and building sewer; and the storm drainage pipes; with their devices, appurtenances and connections to all within or adjacent to the building.

Historical Background

- Since the dawn of civilization plumbing and sanitation has been part of human lives. All human beings, regardless of culture and race had been practicing the act of disposing waste since time immemorial.

- Historians, in their attempt to trace the history of plumbing, events which had brought about changes that led towards the plumbing system that we know today, had painstakingly devised records of chronological events.

Historical Background

- The first artifact to have been unearthed was a copper pipe used in a water system in the ancient palace ruins in the Indus Valley. It was estimated to be 5,500 years old. Such discovery established the earliest known knowledge on plumbing systems.
- Around 2,500 BC, the Egyptians used copper pipes in their irrigation and sewerage systems. In the ancient Babylon, the science of hydraulics had been established as evidenced by their skillful planning in their network of canals. The inhabitants of Crete to collect water for drinking, washing, bathing and cooking purposes, constructed freshwater cisterns.

Historical Background

- During the Roman Empire (500BC - 455AD), enormous concerns on the field of sanitation and plumbing had been observed those times. Aqueducts were built to convey water from sources to houses. Extensive underground sewer systems were constructed. Notable among these developments is the construction of underground public water supply system made of cast lead sections.

- Public baths had proliferated; one particular example is the Bath of Diocletian, a bath that could accommodate 3,200 bathers at one time. These baths were lines with ceramic tiles. In addition. Roman bathhouses also include large public latrines, sometimes with marble seats.

- The quality of plumbing declined after the fall of the Roman Empire in AD.. 476. During the middle ages, people disposed of waste materials by throwing them into the streets. !n 1500's, a type of water closet was developed. Septic tanks were introduced in the mid-1800's, and a modern sewerage system began operating in London in the 1860's.

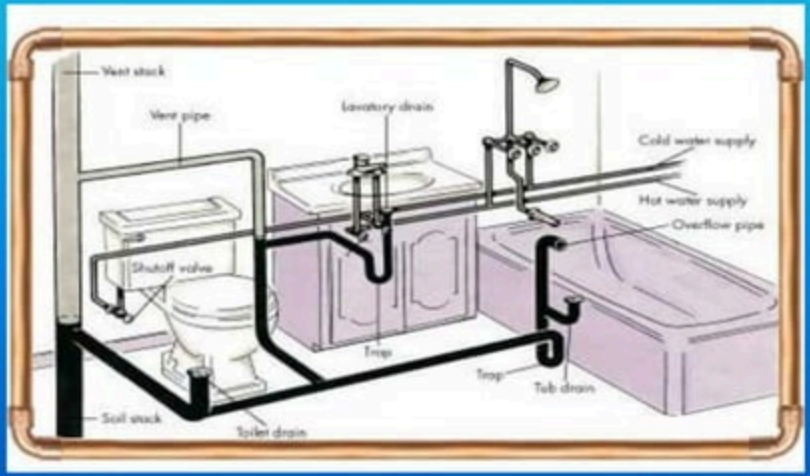
Roman Aqueducts

Roman Bathhouse (Thermae)

Roman lead pipe with a folded seam

Definitions and Basic Plumbing Principles
Plumbing System

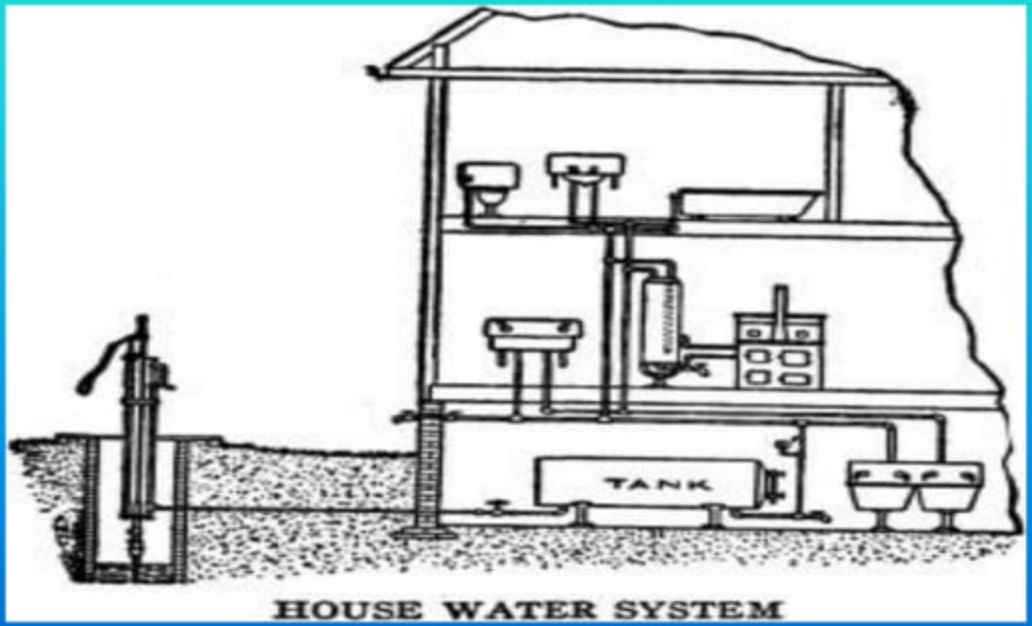
- The plumbing system of a building includes the water supply distributing pipes; the fixture and fixture traps; the soil, waste and vent pipes; the building drain and building sewer; the storm water drainage, with their devices, appurtenances and connections within the building and outside the building within the property line.



Water Supply System

- A system in plumbing which provides and distributes water to the different parts of the building or structure, for purposes such as drinking, cleaning, washing, culinary use, etc.; it includes the water distributing pipes, control devices, equipment, and other appurtenances.

Water Supply System

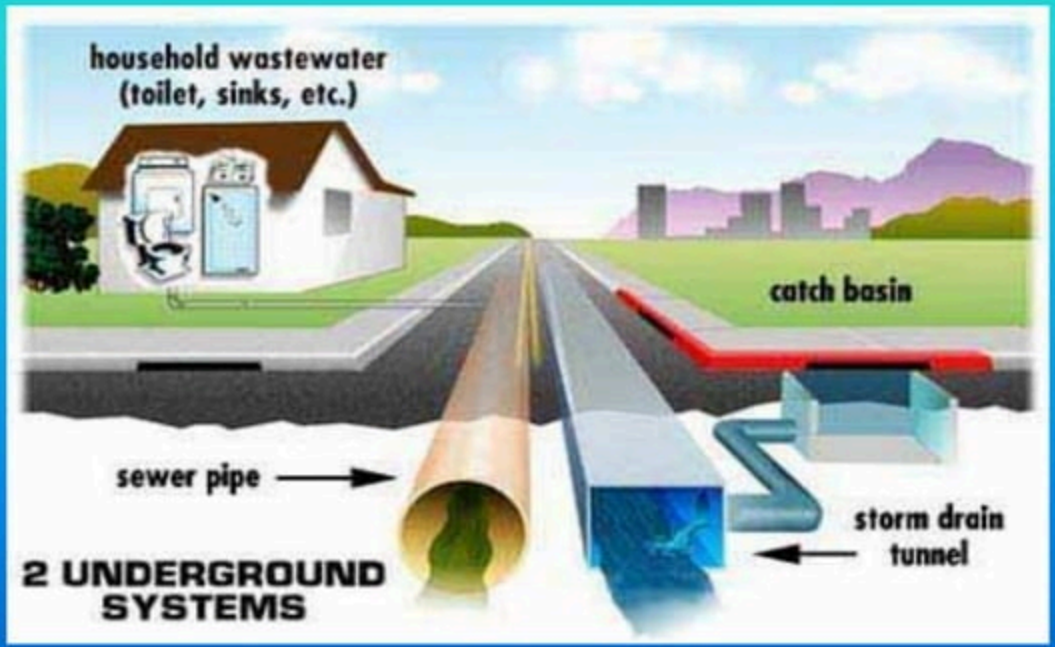


HOUSE WATER SYSTEM

Drainage System

- All the piping within a public or private premises which conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of public sewer systems or a private or a public sewage treatment or disposal plant.

Drainage System



Sanitary Drainage and Vent Piping System

- The sanitary drainage and vent piping system are installed by the plumber to remove wastewater and water-borne wastes from the plumbing fixtures and appliances, and to provide circulation of air within the drainage piping.

Sanitary Drainage

Vent Piping System

Sanitary Drainage Pipes

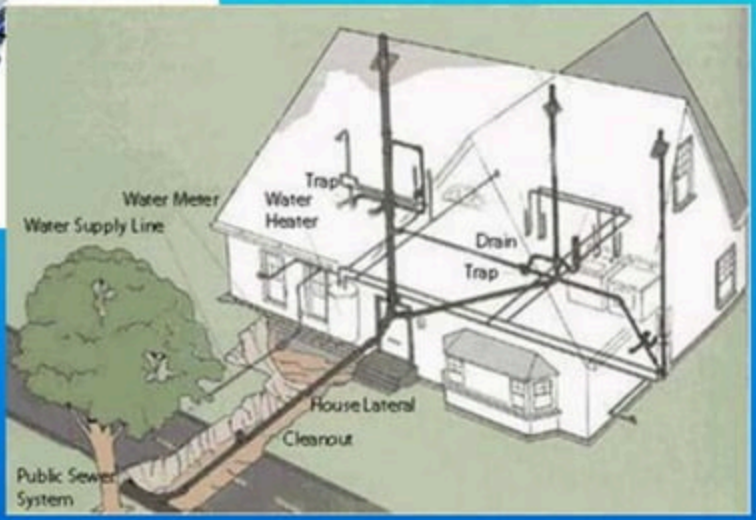
- Pipes installed to remove the wastewater and water-borne wastes from plumbing fixtures and convey these to the sanitary sewer and other point of disposal.

SANITARY DRAINAGE SYSTEM

- BUILDING/HOUSE SEWER

That part of the drainage system that extends from the end of the building drain and conveys its discharge to the public sewer, private sewer, individual sewage disposal system, or other appropriate point of disposal.


HEATING PIPE BURST
DRAIN DOWN
UNBLOCK TOILET
LEAKING HOT WATER HEATER
LEAKING TOILET
BURST PIPE
BURST MAIN PIPE
DRAIN COLLAPSE
BLOCKED DRAIN


Water Meter
Water Supply Line
Trap
Water Heater
Drain
Trap
House Lateral
Cleanout
Public Sewer System

Privy

– The oldest form of disposal of organic waste
– It consists of a water tight vault constructed of concrete for the collection of raw sewage and a wooden shelter.
– It must be 50′ to 150′ (15m to 45 m) away from the water supply
– The vault should be supplied with ventilation
– It should be screened and protected from vermin and flies.

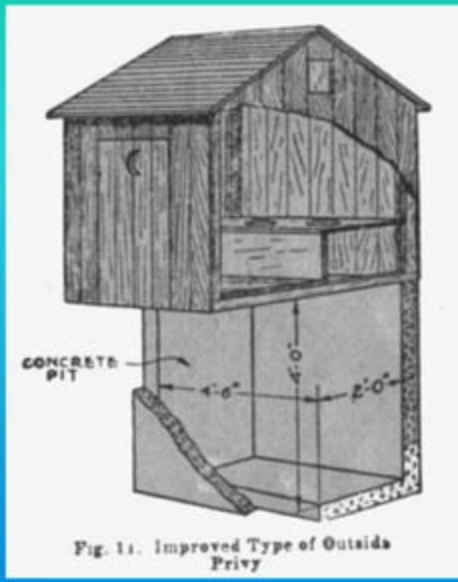


Fig. 11. Improved Type of Outside Privy

Septic Tank and Seepage Pit

– In this type of sewage disposal, the cycle is completed below ground and within the property. Liquid wastes are purified due to the action of anaerobic bacteria through precipitation in the digestion chamber and effluent is discharged in the leaching chamber by natural percolation.
- Effluent –liquid discharge
- Scum- non-soluble organic matter that floats on the surface of the sewage
- Sludge- organic matter that settles at the base of the septic tank

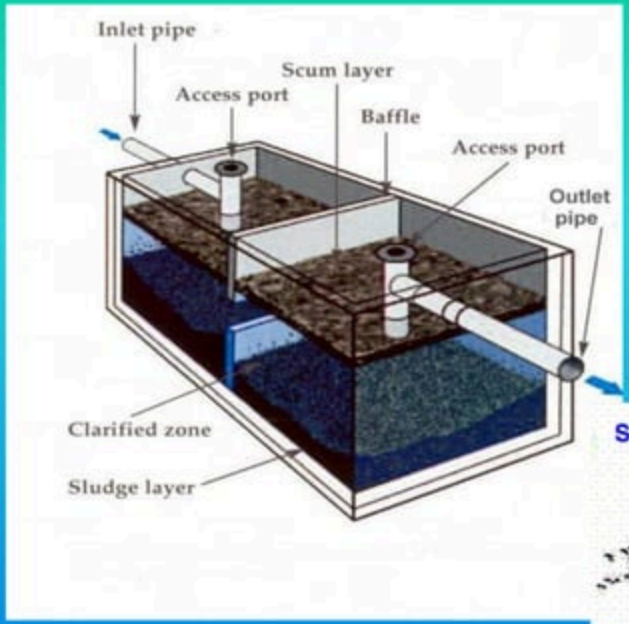
- Size of tank:

Residence

- 6 persons min capacity of 50 cu ft, and for larger household 5-6 cu. ft/person

Commercial, industrial and institutional

- 2-3 cu ft/person
- Location must be near the structure served: (5') 1.50 m
- water-tight and gas-tight and 50' –150' (15m-45m) away from water sources


Inlet pipe
Scum layer
Access port
Baffle
Access port
Outlet pipe
Clarified zone
Sludge layer


SeptClean 250FE
SeptClean keeps Soakaways
Clear and Odor Free
SeptClean Keeps Septic Tanks
Cesspools and Grease Traps
Free Flowing and Odor Free
SeptClean 250FE
The Biological Solution To Waste Pollution

Parts of a Sanitary Drainage System

SPECIAL DEVICES:

- Interceptors
- Sumps and Ejectors
- Backwater Valves
- Roof and Floor Drains

ESSENTIAL COMPONENTS:

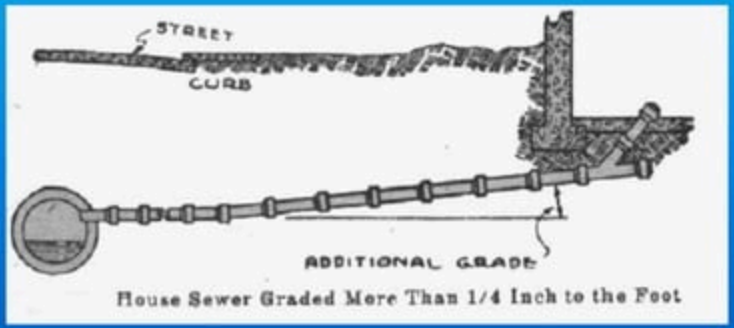
- House Sewer
- House Drain
- House Trap
- Fresh-air inlet
- Soil and Waste Stacks
- Fixture Branches
- Traps
- Vents

House Sewer

– It extends from the public sewer to the private sewage-disposal tank to the wall of the structure and is entirely outside the building

- Glazed vitrified clay – min. 6" –36 " Ø, 2'-3' long
- Cast-iron min. 4" Ø, 5' to10' long
- Copper – 12' to 20' long
- Plastic pipe –10' to 20' long

– 12" deep with concrete pavement
– 18" deep without concrete covering
– Slope at 1/8" or ¼" to the foot



House Sewer Graded More Than 1/4 Inch to the Foot

House Drain

– The horizontal main into which the vertical soil and waste stacks discharge. It connects directly to the house sewer.

– Sanitary drain

– Leader drain

- Copper
- Plastic
- Extra heavy cast-iron

– Slope at 1/8" or ¼" per foot

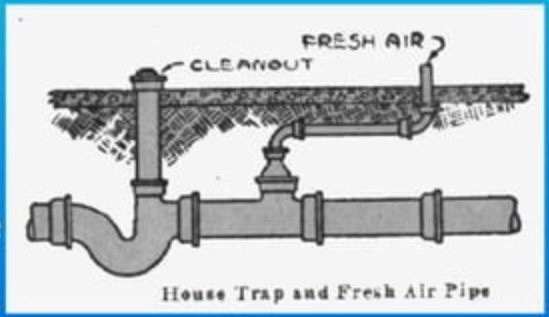
– A cleanout at the cellar/basement wall is recommended to clear obstructions

– A cleanout at the foot of each waste and soil stack should be installed

Fresh-air inlet

– It is intended to admit fresh air to the drainage system so that there will be a free circulation without compression throughout the house drain and stacks discharging above the roof

– A necessary adjunct to the house trap



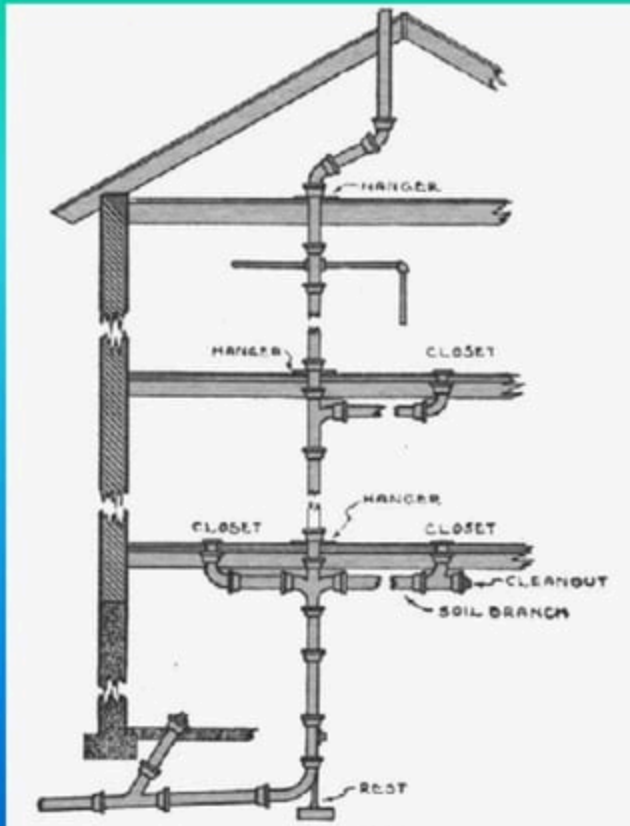
House Trap and Fresh Air Pipe

Soil and Waste Stacks

– The soil and waste stacks collect the sewage from the fixtures through their branches.

- Should rest solidly at the bottom on masonry piers or heavy posts
- The upper ends should extend through the roof for ventilation
- Made of heavy cast-iron, copper, plastic

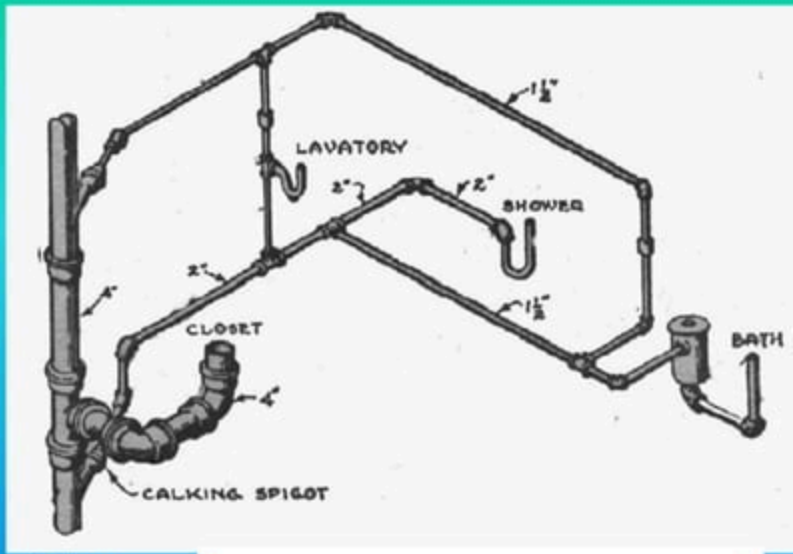
- Supported at intervals of 10′ with stout wall hangers or brackets or on beams
- Min 4″ Ø 1′ below the roof
- It should be straight free of bends and turns



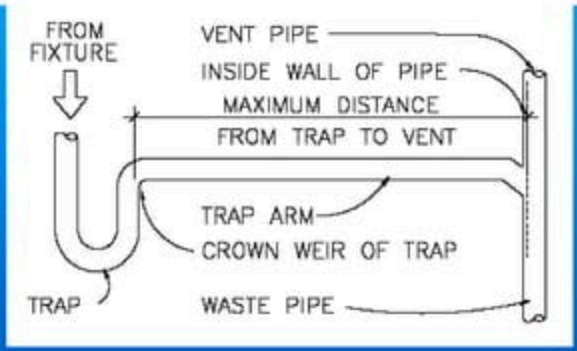
Soil Pipe

Fixture Branches

– Connect the fixtures with the stacks
– Waste or soil branches are connected to the trap of each fixture



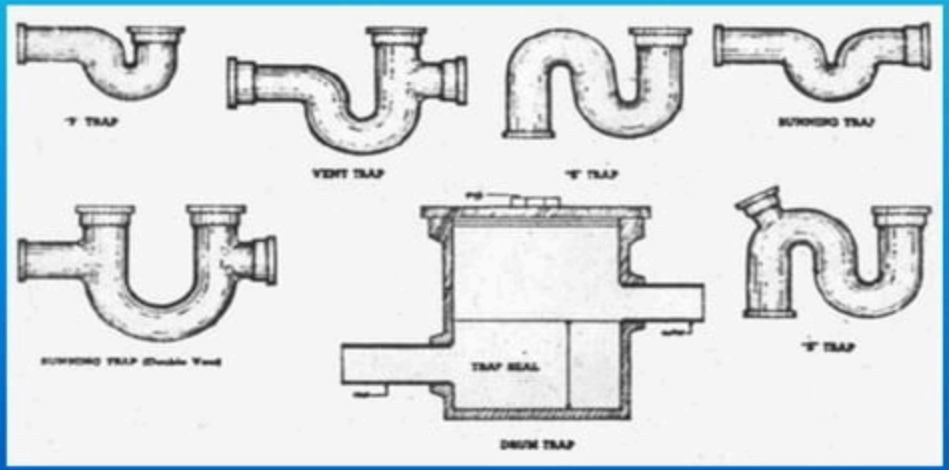
– 1/8" – ½" per foot
– Horizontal branch should not be more than 5' (from the vertical inlet of the trap to the vent opening
– Cast-iron, plastic, copper or galvanized steel



Traps

– Traps catches water after each discharge from a fixture so as not to allow unpleasant ad obnoxious gases in a sanitary drainage system to escape through the fixture

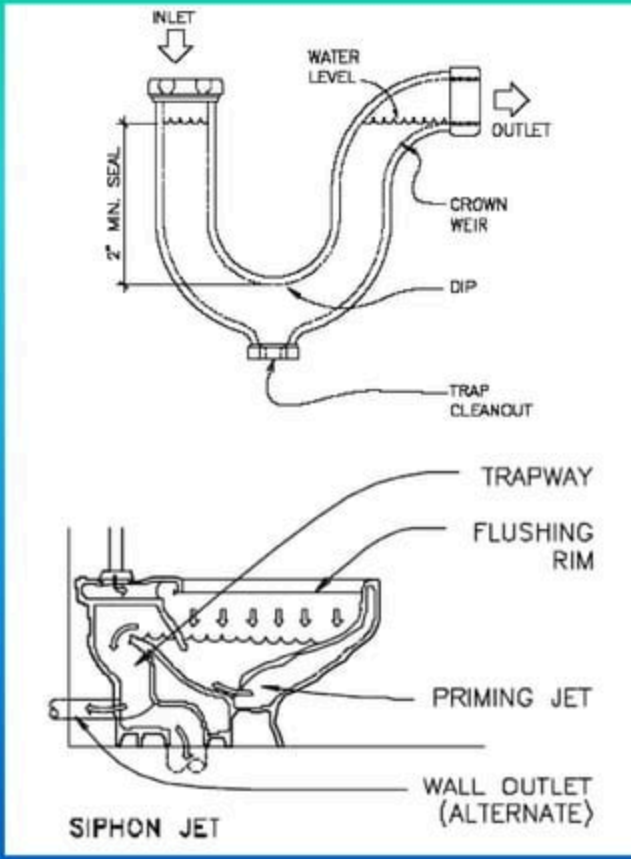
– All fixtures are to be provided with its own trap except for three laundry and kitchen sinks connected to a single trap



– Trap seal must have a min depth of 2″ and max of 4″ depth

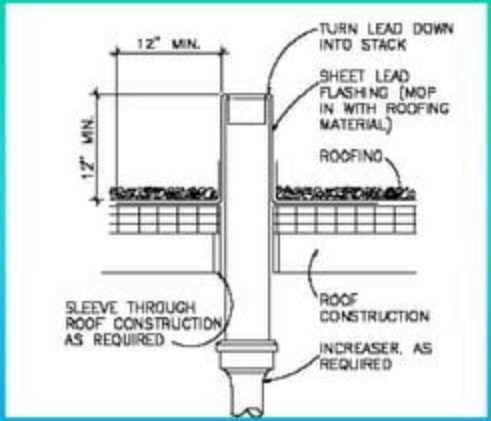
– Placed within 2′ of the fixture accessible for cleaning through its bottom with a plug

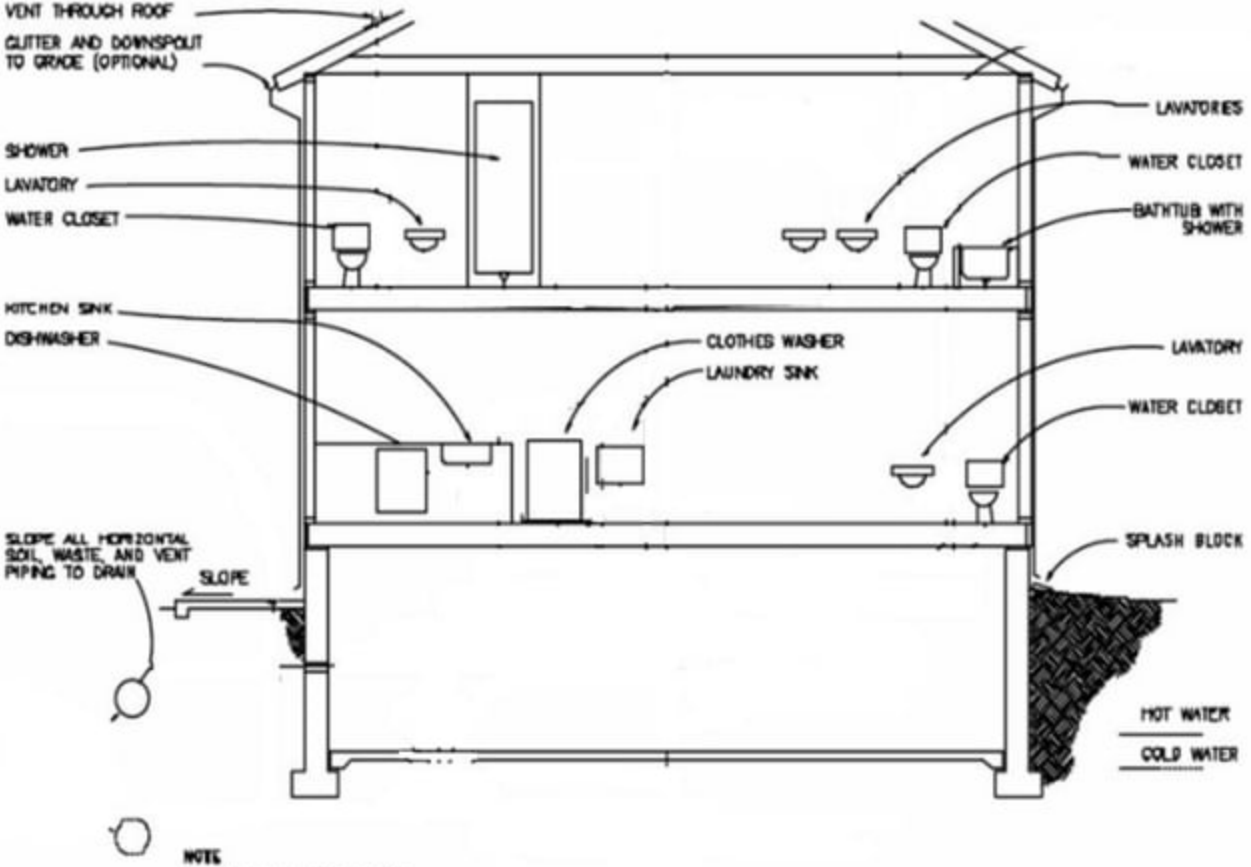
– Made of steel, cast-iron, copper, plastic and brass except those in urinals and water closets which are made of vitreous china cast integrally with the fixture

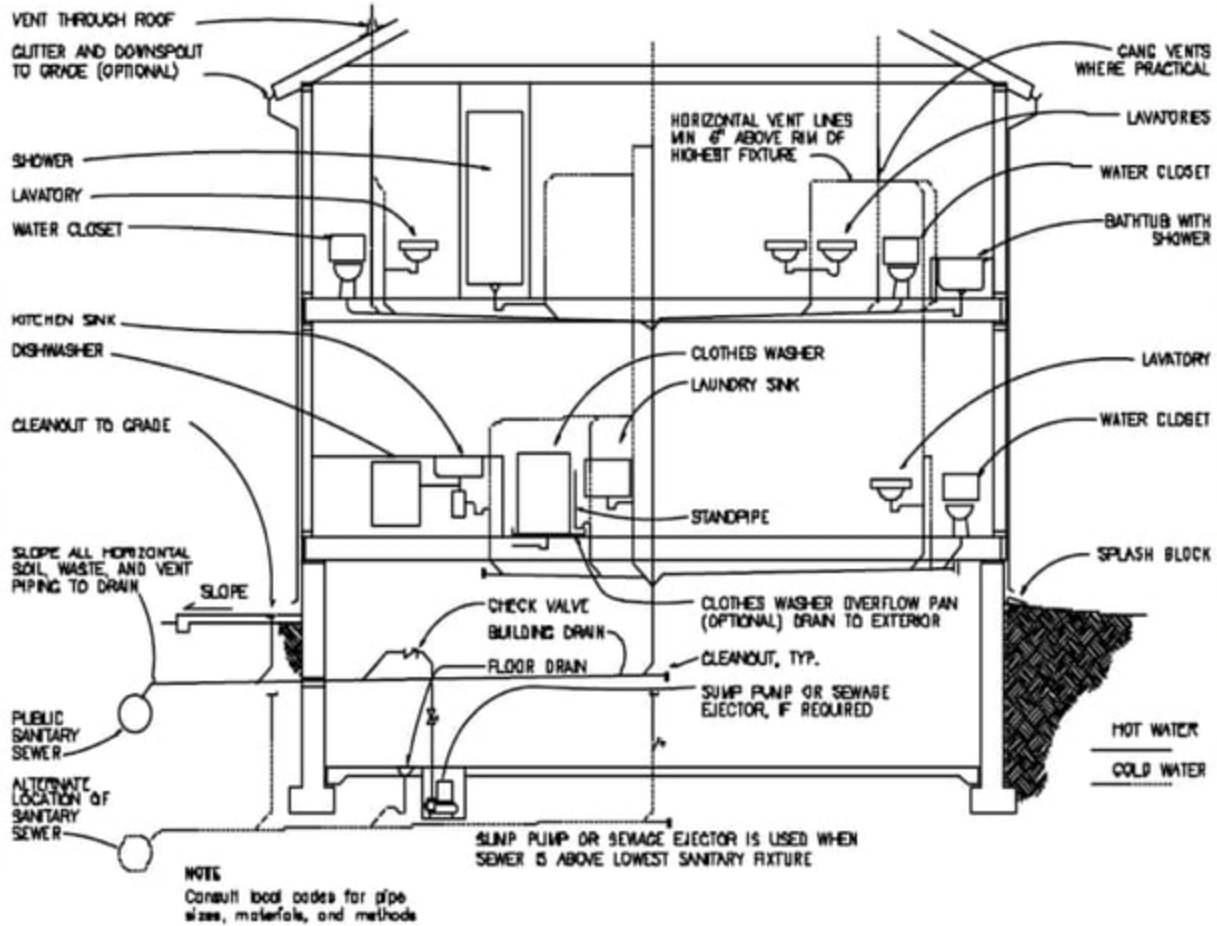


Vents

– Vents are the extension of soil and waste stacks through the roof and a system of pipes largely paralleling the drainage system for the admission of air and discharging of gases.

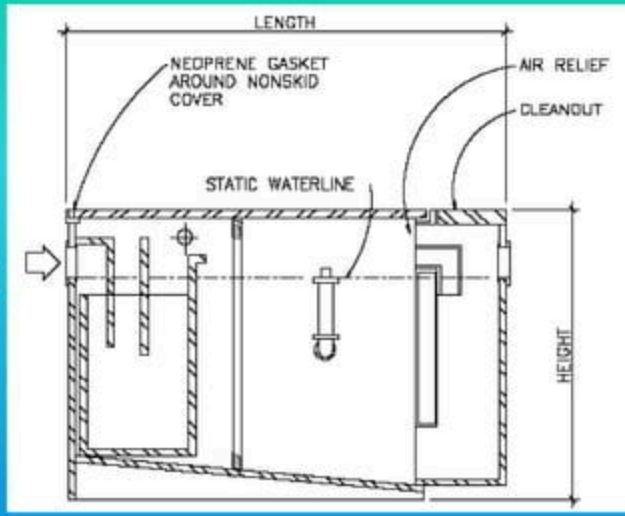



VENT THROUGH ROOF
GUTTER AND DOWNSPOUT TO GRADE (OPTIONAL)
SHOWER
LAVATORY
WATER CLOSET
KITCHEN SINK
DISHWASHER
SLOPE ALL HORIZONTAL SOIL, WASTE, AND VENT PIPING TO DRAIN
SLOPE
LAVATORIES
WATER CLOSET
BATHTUB WITH SHOWER
CLOTHES WASHER
LAUNDRY SINK
LAVATORY
WATER CLOSET
SPLASH BLOCK
HOT WATER
COLD WATER
NOTE
Consult local codes for pipe sizes, materials, and methods


VENT THROUGH ROOF
GUTTER AND DOWNSPOUT TO GRADE (OPTIONAL)
SHOWER
LAVATORY
WATER CLOSET
KITCHEN SINK
DISHWASHER
CLEANOUT TO GRADE
SLOPE ALL HORIZONTAL SOIL, WASTE, AND VENT PIPING TO DRAIN
SLOPE
PUBLIC SANITARY SEWER
ALTERNATE LOCATION OF SANITARY SEWER
HORIZONTAL VENT LINES MIN 6" ABOVE RIM OF HIGHEST FIXTURE
CLOTHES WASHER
LAUNDRY SINK
STANDPIPE
CHECK VALVE
BUILDING DRAIN
FLOOR DRAIN
CLOTHES WASHER OVERFLOW PAN (OPTIONAL) DRAIN TO EXTERIOR
CLEANOUT, TYP.
SUMP PUMP OR SEWAGE EJECTOR, IF REQUIRED
SUMP PUMP OR SEWAGE EJECTOR IS USED WHEN SEWER IS ABOVE LOWEST SANITARY FIXTURE
NOTE
Consult local codes for pipe sizes, materials, and methods
CANC VENTS WHERE PRACTICAL
LAVATORIES
WATER CLOSET
BATHTUB WITH SHOWER
LAVATORY
WATER CLOSET
SPLASH BLOCK
HOT WATER
COLD WATER

Interceptors

– device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal waste and permit normal sewage or liquid waste to discharge into the disposal terminal by gravity

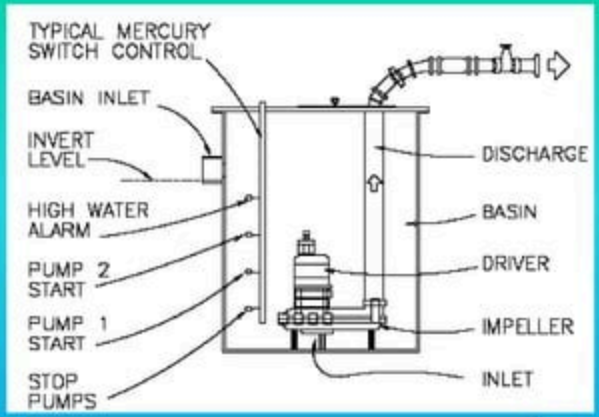


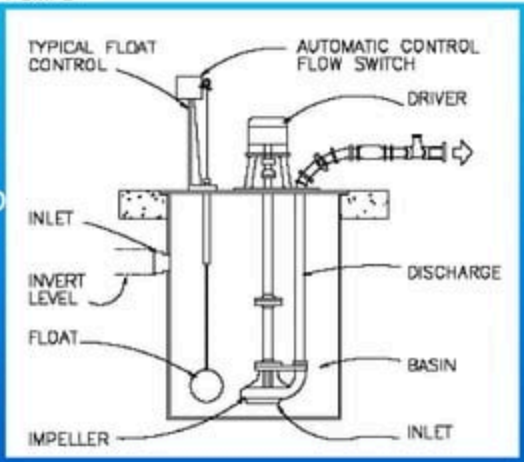
Sump and Ejectors

– A sump is a tank or a pit which receives sewage or liquid waste, located below the normal grade of the gravity system and must be emptied by a mechanical means

– Sewage ejectors may be motor-driven centrifugal pumps or they may be operated by compressed air.

Ejector pump for submersible system
Ejector for Vertical lift submerge pump

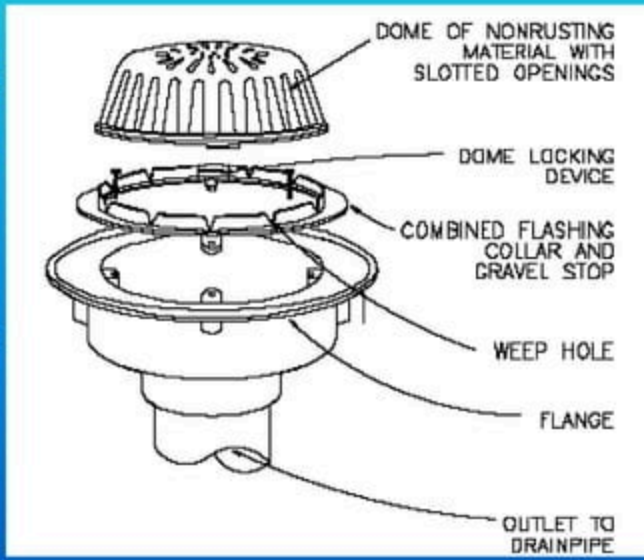


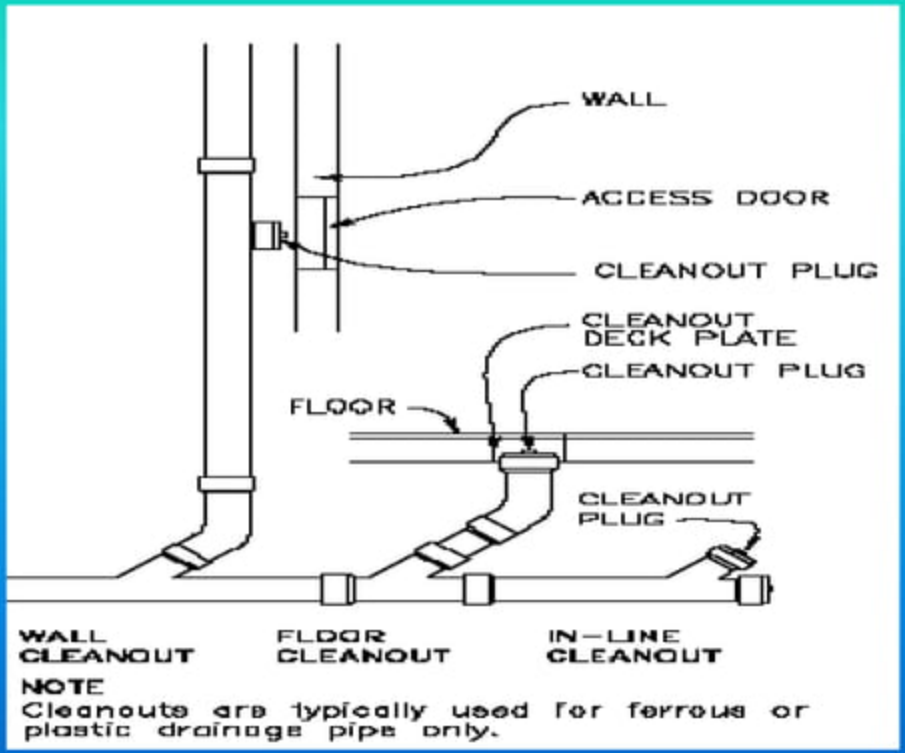


Backwater valves/check valve
– A backwater valve closes to prevent reverse flow from a sewer to low facilities when there is a heavy drainage load for short periods that can cause building up and over flow of wastes.

Roof Drain
– Is a receptacle designed to collect surface or rain water from an open area and discharge to a catch basin

Floor Drain
– Is any pipe which carries water or waterborne wastes in a building drainage system




WALL
ACCESS DOOR
CLEANOUT PLUG
CLEANOUT
DECK PLATE
CLEANOUT PLUG
FLOOR
CLEANOUT
PLUG
WALL
CLEANOUT
FLOOR
CLEANOUT
IN-LINE
CLEANOUT
NOTE
Cleanouts are typically used for ferrous or plastic drainage pipe only.

Is that portion of the drainage installation designed to maintain atmospheric pressure within it

• and prevent at least three major difficulties:

– Retardation of flow

– Material deterioration

– Trap seal loss

Retardation of flow.

• The result of improper atmospheric conditions, because of insufficient ventilation or incorrect installation of fittings.

• Increased pressure causes retarded flow in the vertical stack and also affects the discharge capacity of its branches

– **Material deterioration.**

• Wastes create chemical compounds of an acid nature which deteriorates the piping system. Objectionable gases should be eliminated by proper ventilation.

– **Trap seal loss**.

• Attributed to inadequate ventilation of the trap and the subsequent minus and plus pressure which occur

- Five ways in which trap seal is lost:
  - Siphonage (direct or indirect)
  - Back Pressure
  - Capillary Attraction
  - Evaporation
  - Wind Effect

Siphonage is the result of a minus pressure in the drainage system
– **Direct siphonage/selfsiphonage** is common in unventilated traps which serve oval-shaped fixtures (lavatories, small slop sink)

Siphonage
– **Indirect siphonage** or **siphonage by momentum** is the result of a minus pressure in the waste piping caused by discharge of water from a fixture installed on a line which serves a fixture placed at a lower elevation.
– No possibility of re-seal.

Back-pressure is caused by a plus pressure in large plumbing installations

– The fixtures in which it occurs are usually located at the base of a soil stack or where soil pipe changes its direction.

– Ventilate the base of the soil pipe to correct this condition

Capillary attraction,

trap seal is caused by suspension of foreign object (rag, string, lint, hair) into the trap seal extending over the outlet arm of the trap.

– The object serves as an absorbing siphon.

Evaporation of the trap seal is a phenomenon of nature.
– The atmosphere absorbs moisture and varies inversely with temperature
– It requires weeks to evaporate trap seal
– Deep seal traps are recommended when air is not saturated with moisture

Wind effects
– Wind of high velocity passing over the top of the soil pipe roof terminal affects trap seal.
– Downdrafts tends to ripple the liquid content of the trap and spill quantity of it over its outlet leg into the system.
– Soil vent terminals should be away from valleys, gables, abrupt projections of the roof where wind can strike and be directed to the terminal

Main Soil and Waste Vent

– Is that portion of the soil pipe stack above the highest installed fixture branch extending through the roof .

– The same diameter as the water-carrying portion of the soil or waste pipe

• (2″-4″ Ø)

Main Vent

– Is that portion of the vent pipe system which serves as a terminal for the smaller, tributary forms of individual and group fixture trap ventilation (collecting vent line)

– It begins at the base of the soil-pipe stack to relieve it from back pressure and terminates in the soil –pipe stack 3’ above the highest fixture branch

Wet Vent
– a wet vent is a method of ventilation used rather extensively for small groups of bathroom fixtures
– A portion of the vent system through which liquid wastes flow

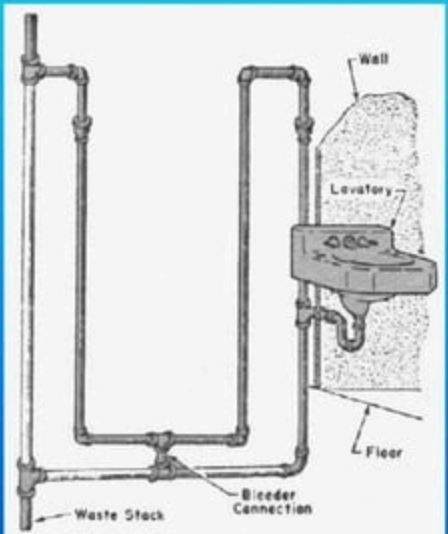


Fig. 173. Looped Vent

Looped Vent
– used on fixtures which are located in the room away from partitions that might be utilized to conceal the waste and vent
– A bleeder or drip connection must be made between the waste pipe and the lowest point of the vent line to avoid accumulation of water in the loop vent

Local Vent
– a vent without connection with the plumbing system
– It terminates at the roof and connected to the fixture at point below the seat

Utility vent
– Used for underground public restrooms

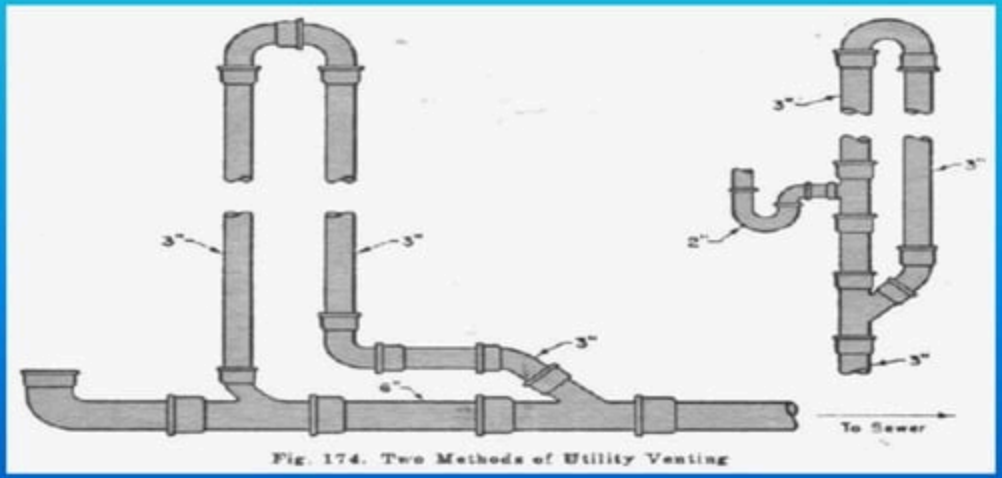


Fig. 174. Two Methods of Utility Venting

Ventilation System

- A system of pipes, fittings and other devices installed for the purpose of providing circulation of air and creating balanced atmospheric condition within the system thereby preventing siphonage and backpressure.

Soil Pipe

- A pipe that conveys the discharge of water closets or similar fixtures containing fecal matter, with or without the discharge of other fixtures to the building drain or building sewer.

Waste Pipe

- A pipe that conveys only liquid waste free of fecal matter.

  A waste pipe is generally smaller than a soil pipe because of the nature of matter being discharged into the system. A waste pipe may be connected directly or indirectly depending on the type of fixture.

Plumbing System Components

- Water Supply and Distribution System
  - Cold Water Supply System
  - Hot Water Supply System
- Sanitary Piping System
- Soil Piping System
- Waste Piping System
  - Direct Waste Piping System
  - Indirect Waste Piping System
- Ventilation System
- House Drain
  - House Sewer
  - Drainage Cleanout
  - Plumbing Traps
- Plumbing Valves
- Storm Drainage Systems
- Sewage Disposal Systems
- Plumbing Fixtures

PLUMBING

The word "**plumbing**" comes from the Latin word plumbum for lead, as pipes were once made from lead.

- Plumbing is the system of pipes, drains, fittings, valves, valve assemblies, and devices installed in a building for the distribution of water for drinking, heating and washing, and the removal of waterborne wastes, and the skilled trade of working with pipes, tubing and plumbing fixtures in such systems.

- "Plumbing" is often denotes the supply and waste system of an individual building, distinguishing it from water supply and sewage systems that serve a group of buildings

COMPONENTS

- PIPES
  - PEX
  - Copper piping
  - PVC
  - Galvanized pipe
  - Brass
  - Cast Iron piping
  - Cement pipe
- PIPE FITTINGS
  - Coupling
  - Reducer
  - Valves
  - Elbow
  - Unions
  - Tee
  - Cross
  - Cap
  - barb

PIPES

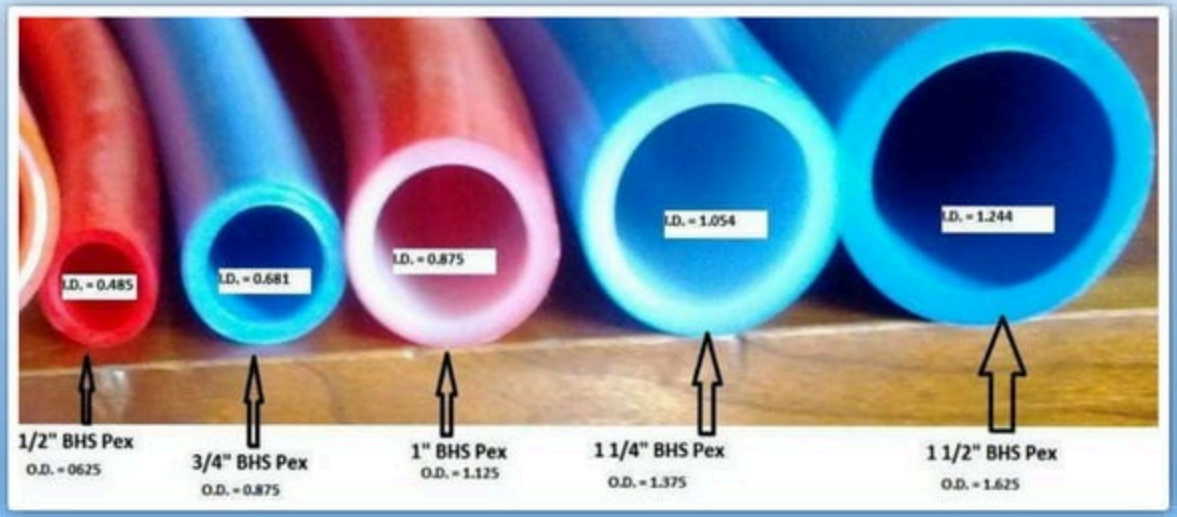
A hollow cylinder following certain dimension rules.

Various types of pipes are described below:

PEX

- Flexible plastic piping.
- Popular selection in residential and small business applications.
- Slightly higher initial cost.
- Minimum maintenance and fast installation process.
- Leak free product offering advantages over copper piping.
- Cannot be used in outdoor application as UV rays can damage its outdoor plastic layer.

- Diameters of the following pipes shown below :



COPPER PIPING

- Copper piping is most often used for supply of hot and cold tap water, and as refrigerant line in HVAC systems(heating, ventilation, and air conditioning).
- There are two basic types of copper tubing :

1. Soft copper
2. Rigid copper

Soft copper pipe

- Soft (or ductile) copper tubing can be bent easily to travel around obstacles in the path of the tubing. While the work hardening of the drawing process used to size the tubing makes the copper hard/rigid, it is carefully annealed to make it soft again; it is therefore more expensive to produce than non-annealed, rigid copper tubing.
- Most popular choice for refrigerant lines in *split-system* air conditioners and heat pumps.

Rigid copper

- Rigid copper is a popular choice for water lines.
- It is joined using a sweat, roll grooved,compression or crimped/pressed connection.
- Rigid copper, rigid due to the work hardening of the drawing process, cannot be bent and must use **elbow fittings** to go around corners or around obstacles.
- If heated and allowed to slowly cool in a process called annealing, rigid copper will become soft and can be bent/formed without cracking.

PVC

- PVC full name is **Poly Vinyl Chloride.**
- Used for hot and cold potable water as well with sewage application.
- Vary on their thickness and configuration depending on the application where to be used.
- Example : pressure water pipes are not the same as sewer pipes and not the same as the ones used on storm drainage systems.

Pvc (hot water)

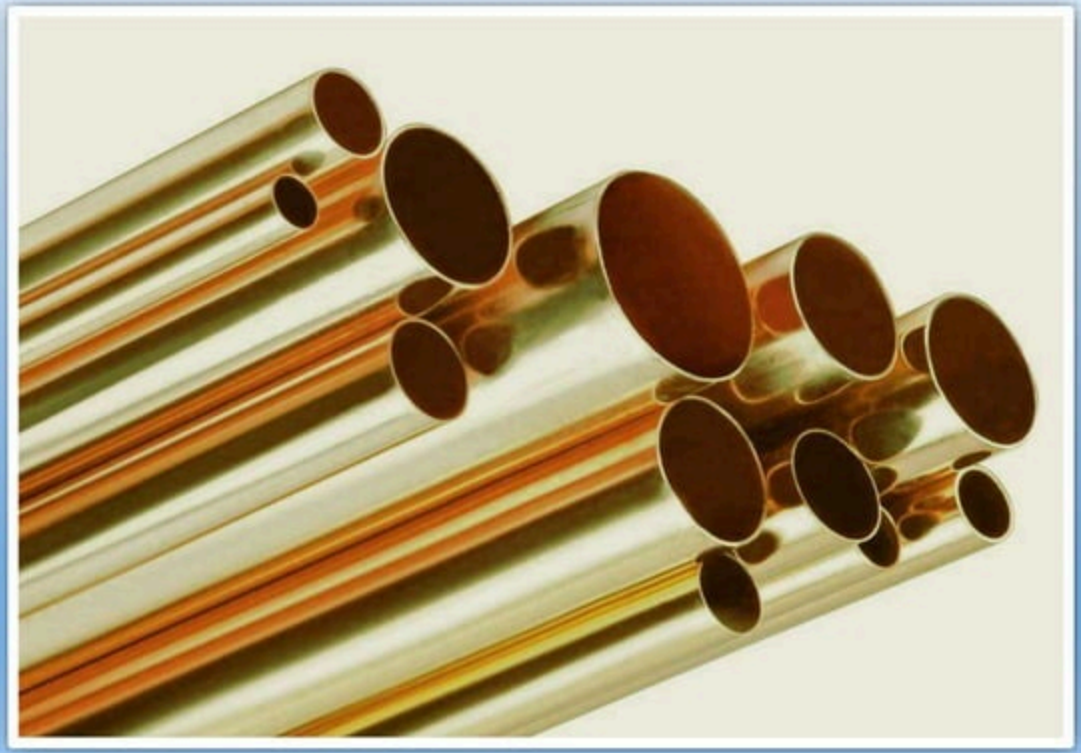
Pvc (cold water)

GALVANIZED PIPING

- Used several years ago.
- Less frequent used now as rust can build up inside small diameter pipes.
- If pipe is old, water coming from the faucet with rust traces can be seen.
- Can be used to transport grey water or non-potable water.
- Use for high temperature or pressure manufacturing processes.
- Use in the petroleum industries.

BRASS

- Brass is an alloy made of **copper** and **zinc**.
- The proportions of zinc and copper can be varied to create a range of brasses with varying properties.
- Provide great rust resistance piping.
- Made of **67%** to **85%** of copper.
- Excellent for hot-water and large distribution systems such as pump fittings, water tanks and wells.
- Generally comes in **12 foot** straight lengths.



PIPE FITTINGS

Fitting is used in pipe plumbing systems to connect straight pipe or tubing sections, to adapt to different sizes or shapes, and for other purposes, such as regulating or measuring fluid flow.

Various common fittings are described below :

PIPE FITTINGS ELEMENTS

COUPLING

- A coupling connects two pipes to each other. If the size of the pipe is not the same, the fitting may be called a reducing couple or reducer, or an adapter.

Size(mm)	Size(in.)	price
15	½	10
20	¾	14
25	1	22
32	1 ¼	39
40	1 ½	71
50	2	148

REDUCER

- A reducer allows for a change in pipe size to meet hydraulic flow requirements of the systems, or to adapt to existing piping of a different size.
- Reducers are usually concentric but eccentric reducers are used when required to maintain the same top-or-bottom of pipe level.

SIZE(MM)	SIZE(IN.)	price
20*15	¾ * ½	16
25*15	1* ½	25
32*15	1 ¼ * ½	59
40*25	1 ½ * 1	81
50*20	2* ¾	192
50*32	2*1 ¼	153
50*40	2*1 ½	201

ELBOW

- Installed between two lengths of pipe or tubing to allow a change of direction, usually a **90 degree** or **45 degree**.
- When its two ends differ in size, the fitting is called **reducing elbow**.

Types of elbows :

- **Long Radius** (LR) Elbows – Radius is **1.5 times** the pipe diameter.
- **Short Radius** (SR) Elbows – Radius is **1.0 times** the pipe diameter.
- **90 degree Elbow** – Where change in direction required is **90 degree**.
- **45 degree Elbow** – Where change in direction required is **45 degree**.

90 degree Elbow

- Also called "**90 bend**" or "**quarter bend**".
- Attaches readily to plastic, copper, cast iron, steel and lead.
- Available in materials like silicone, rubber compounds, galvanized steel, etc
- It connects hoses to valves, water pressure pumps and deck drains.

45 degree Elbow

- Also called "**45 bend**".
- Commonly used in water supply facilities, food industrial pipeline networks, chemical industrial pipeline networks, electronic industrial pipeline networks, air conditioning facility pipeline, etc.

UNIONS

- A **union** is similar to a coupling, except it is designed to allow quick and convenient disconnection of pipes for **maintenance** or **fixture replacement**.
- Standard union pipe is made in three parts consisting of a **nut,** a **female end,** and a **male end**.
- When the female and male ends are joined, the nuts then provide the necessary pressure to seal the joint
- Since the mating ends of union are interchangeable, changing of a valve or other device can be achieved with a minimum loss of time

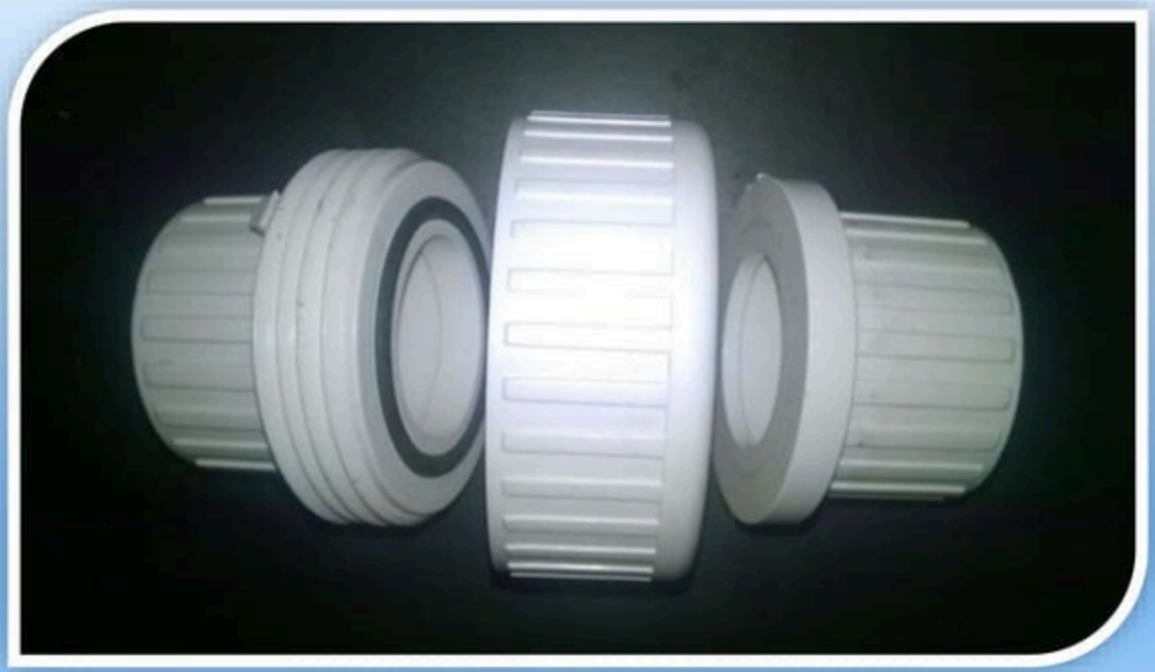
- In addition to standard, simple unions, other types of unions exist:

Dielectric unions :

Unions with dielectric insulation, used to separate dissimilar metals (such as copper and galvanized steel) to avoid he damaging effects of galvanic corrosion.

Rotary unions :

Unions that allow for rotation of one of the united parts.



Size(mm)	Size(in.)	price
15	1/2	40
20	3/4	78
25	1	112
32	1 ¼	131
40	1 ½	218

TEE

- Available with all female thread sockets, all solvents weld sockets, or with opposed solvent weld sockets and a side outlet with female threads.
- used to either **combine** or **split** a fluid flow.
- T-shaped having two outlets at **90 degree** to the connection to the main line.
- Used for connecting pipe of different diameters or for changing the direction of pipe runs.
- Extensively used in pipeline networks to transport **two-phase fluid** mixtures.

Size(mm)	Size(in.)	price
15	½	17
20	¾	27
25	1	42
32	1 ¼	79
40	1 ½	144
50	2	308

CROSS

- Also called **four way** fittings.
- If a branch line passes completely through a **tee**, the fitting becomes a cross.
- It has **one inlet** and **three outlet** or vice versa.
- They often have solvent welded sockets end or female threaded ends.
- Common in fire sprinkler system due to their extra cost.


25 ₹

Size(mm)	Size(in.)	price
15	½	23
20	¾	49

CAP

- A cap is used like **plug**, except that the pipe cap screws or attaches on the male thread of a pipe.
- They may have a solvent weld socket end or a female threaded end and the other end closed off.
- In plumbing systems that use threads, the cap have female threads.
- If a **solvent weld cap** is used to provide for a future connection point, several inches of pipe must be left before the cap because when the cap is cut off for the future connection, enough pipe must remain to allow a new fitting to be glued onto it.

Size(mm)	Size(in.)	price
15	½	8
20	¾	12
25	1	19
32	1 ¼	34
40	1 ½	49
50	2	105

BARB

- Used to connect **flexible hoses** to pipe.
- It has a male threaded end used to mate with the female thread.
- The other end of the fitting has either a single or multiple barbed tube having a tapered stub with ridges, which is inserted into the flexible hose to secure it.
- It can be made of **plastic** or **brass**.

- **Brass barb** is used for **hot** water application while **plastic barb** is used for **cold**.
- The barb can be either **elbow shaped** or **straight**.

NIPPLE

- In plumbing and piping, a **nipple** is a fitting, consisting of a **short piece of pipe**, usually provided with a male pipe thread at each end, for connecting two other fittings.

VALVES

- A **valve** is a device that regulates, directs or controls the flow of a fluid by opening, closing or partially obstructing various passageways.
- The various types of valves are:

Ball valve
Gate valve
Butterfly valve
Diaphragm valve
Pressure Balanced valve
Check valve
Zone valve
Locking valve
Globe valve

BALL VALVE

- A **ball valve** is a form of quarter-turn valve which uses a hollow, perforated and pivoting ball to control flow through it.
- In open position, hole in the sphere is in line with the pipe.
- When closed, hole in the sphere is perpendicular to pipe.
- Lever handle operates the valve and also serves as an indicator for whether the valve is open or closed.

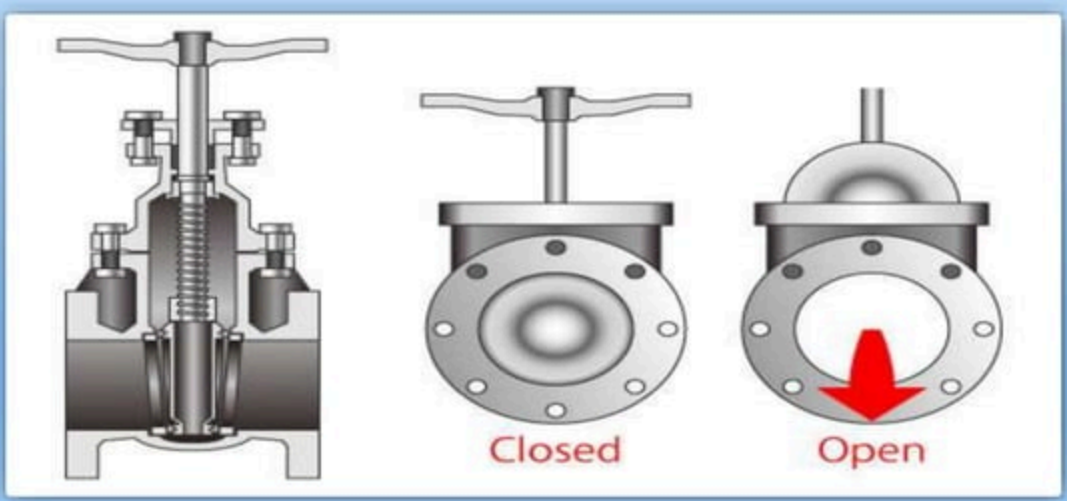
- Ball valves do not allow for precise flow control as they usually have positive stops(0, 45, 90 degrees), but they do provide a very good seal in the closed position.

size*(mm)	Size(in.)	price
15	½	77
20	¾	127
25	1	238
32	1 ¼	422
40	1 ½	663
50	2	1165

GATE VALVE

- A gate valve, also known as a sluice valve, is a valve that opens by lifting a round or rectangular gate out of the path of the fluid.
- Controls water flow by raising or lowering the gate, which is generally a piece of metal.
- Wheel or knob at the top of the gate valve is present that controls the height of the gate – this, in turn, affects the flow of water.
- But unfortunately, the wheel doesn't provide any indication of whether the valve is open or closed.

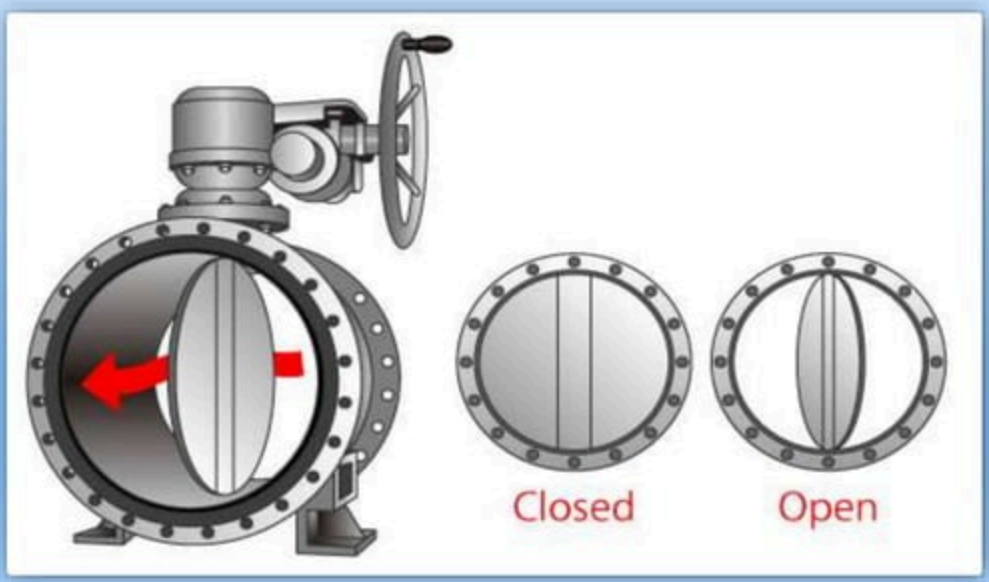
- Not durable
- Susceptible to corrosion, which will cause the valve to get stuck in the open or closed position



BUTTERFLY VALVE

- A butterfly valve is a valve which can be used for isolating or regulating flow.
- The closing mechanism takes the form of a disk. Operation is similar to that of a ball valve, which allows for quick shut off.
- It is attached to a lever handle that rotates the disc, which adjusts the flow of water
- Main drawback : control disc is always present within the flow of water(even when fully open) so there will always be a pressure drop when using them

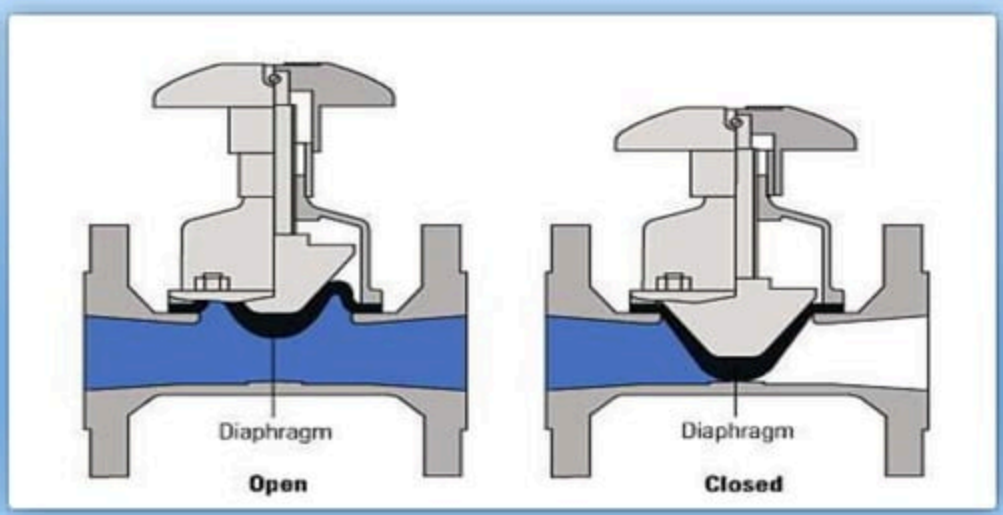
- Butterfly valves are generally favored because they are lower in cost to other valve designs as well as being lighter in weight, meaning less support is required



DIAPHRAGM VALVE

- **Diaphragm valves** (or membrane valves) consists of a valve body with two or more ports, a diaphragm, and a "**weir or saddle**" or seat upon which the diaphragm closes the valve.
- Similar to **gate valve**.
- In a diaphragm valve, the element is a diaphragm that settles down over a saddle, thus stopping water flow.
- The diaphragm below is a **weir-type** diaphragm valve, where water passes over a weir.

- There is also a straight-type diaphragm valve, which doesn't force water over a weir
- This valves are generally used as shutoff or stop valves

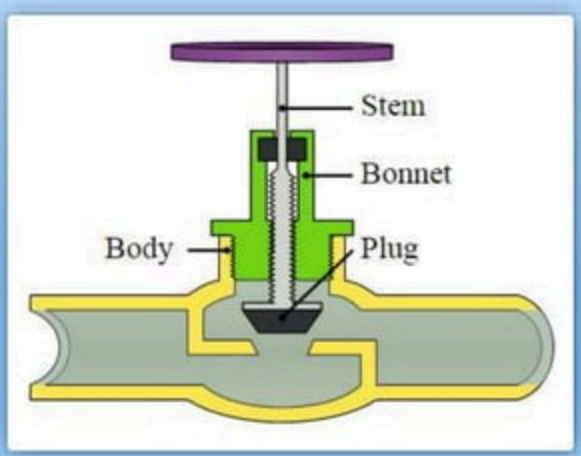


GLOBE VALVE

- A **globe valve**, different from ball valve, is a type of valve used for regulating flow in a pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body.
- Used to **throttle** or **limit** the flow of water.
- Contains a stopper that is raised and lowered by a **wheel** **or** **knob** on a shaft.
- Stopper seals into a baffle to stop flow.

GLOBE VALVE

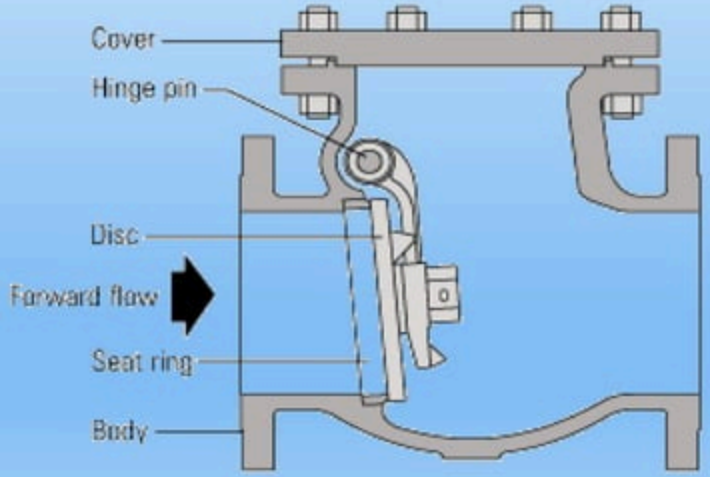
MECHANISM



CHECK VALVE

- A check valve, clack valve, non-return valve or one-way valve is a valve that normally allows to flow through it in only **one direction**.
- Generally not operational.
- **Back-flow preventer** is a type of check valve.
- A ball-check valve uses a ball to **stop** the flow of water in wrong direction.
- A diaphragm-check valve has a **rotating disc** or **rubber flap** that is pushed to seal the opening in the event of flow in the wrong direction.

- A **stop-check valve** is operational and allows a user to completely stop all flow – even flow in the correct direction. It will not allow **backward flow** when open.



PRESSURE BALANCED VALVE

- A pressure-balanced valve provides water at nearly constant temperature to a shower or bathtub, despite pressure fluctuations in either the hot or cold supply lines.
- Diaphragm within the valve allows the operator to set mixing of hot and cold water
- Many jurisdictions require pressure balanced valves in domestic bathrooms and showers to prevent accidental scalding
- If, for example, someone flushes a toilet while the shower is in use.

ZONE VALVE

- A **zone valve** is a specific type of valve used to control the flow of water or steam in a hydronic heating or cooling system.
- May be provided in different rooms, floors, or dwelling units so that each place can have local control over the **heating** or **cooling**.
- Electrically controlled and are connected to a thermostat so that automatic control is achieved.

LOCKING VALVE

- Almost any type of valve can be locked to avoid accidental or intentional opening or closing
- Valves with lever-type handles allow for more secure locking control
- Provide aligning holes so that lock can be passed to stop rotation of the handle
- Locks preventing adjustment to non-locking valves are also designed