TVET CERTIFICATE IV in PLUMBING

PIPE WORK DRAWING

PLBPD401

PERFORM PIPE WORK DRAWING

Competence

RTQF LEVEL: 4

Credits:12

Learning hours:

Sector: CONSTRUCTION

120

Sub-sector: PLUMBING

Module Note Issue date: NOVEMBER, 2020

Purpose statement

This module describes the skills, knowledge and attitudes to be acquired by the leaner to draw pipe work in the workshop. It also presents the plumbing symbols, views and sections. Pipe work drawing by CAD is crucial in plumbing arts in order to have a correct and precise drawing within a short time

Learning assumed to be in place

Health, safety and environment in the workplace

Elements of competence and performance criteria

Learning units describe the essential outcomes of a competence.

Performance criteria describe the required performance needed to demonstrate achievement of the learning unit.

By the end of the module, the trainee will be able to:

Table of Contents

Learning Unit 1 – Prepare the work

LO 1.1:Select Tools and Equipments.

Content/Topic 1(Drawing tools)

Drawing is a creative way to express the feelings and thoughts of an artist or designer.
A **drawing** can be a **sketch**, a plan, a design, or graphic representation made with the help of pens, pencils, or crayons. The final result depends upon **its** nature and purpose

Drawing tools
Definition: Drawing tool are tools may be used for measurement and layout of drawings, or to improve the consistency and speed of creation of standard drawing elements
Among the drawing tools we can say:
Among the drawing tools we can say:

- **Pencil**: a thin cylindrical instrument used for writing, drawing, etc. consisting of a rod of graphite or other marking substance, usually either encased in wood and sharpened or held in a mechanical metal device. (as modifier)a **pencil** drawing.

Figure showing drawing pencil

- **Ruler**: sometimes called a rule or line gauge, is a device used in geometry and technical drawing, as well as the engineering and construction industries, to measure distances or draw straight lines.

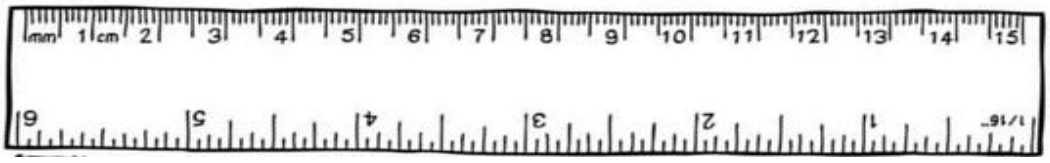


Figure showing drawing Ruler

- **Rubber**: Is a tool used for erasing extra pencil lines


Figure showing rubber

- **Curved rulers**: The French curve is the most common curved ruler used for fashion design. (It's the translucent ruler shown above.) It's especially handy for making common fitting or pattern adjustments.

French curves are a set of curvilinear rulers used in industrial design, before the advent of CAD, when everything still had to be drawn by hands.

Figure showing drawing curves

- **Ink pen:**

A **pen** is a common writing instrument used to apply **ink** to a surface, usually paper, for writing or drawing. The pen draws ink from the reservoir through a feed to the nib and deposits it on paper via a combination of gravity and capillary action. Filling the reservoir with ink may be achieved manually, via the use of an eyedropper or syringe, or via an internal filling mechanism which creates suction (for example, through a piston mechanism) or a vacuum to transfer ink directly through the nib into the reservoir. Some pens employ removable reservoirs in the form of pre-filled ink cartridges

Figure showing drawing ink pen

- **Set Square:**

A set square or triangle (American English) is an object used in engineering and technical drawing, with the aim of providing a straightedge at a right angle or other particular plan or angle to a baseline.

Types of set squares

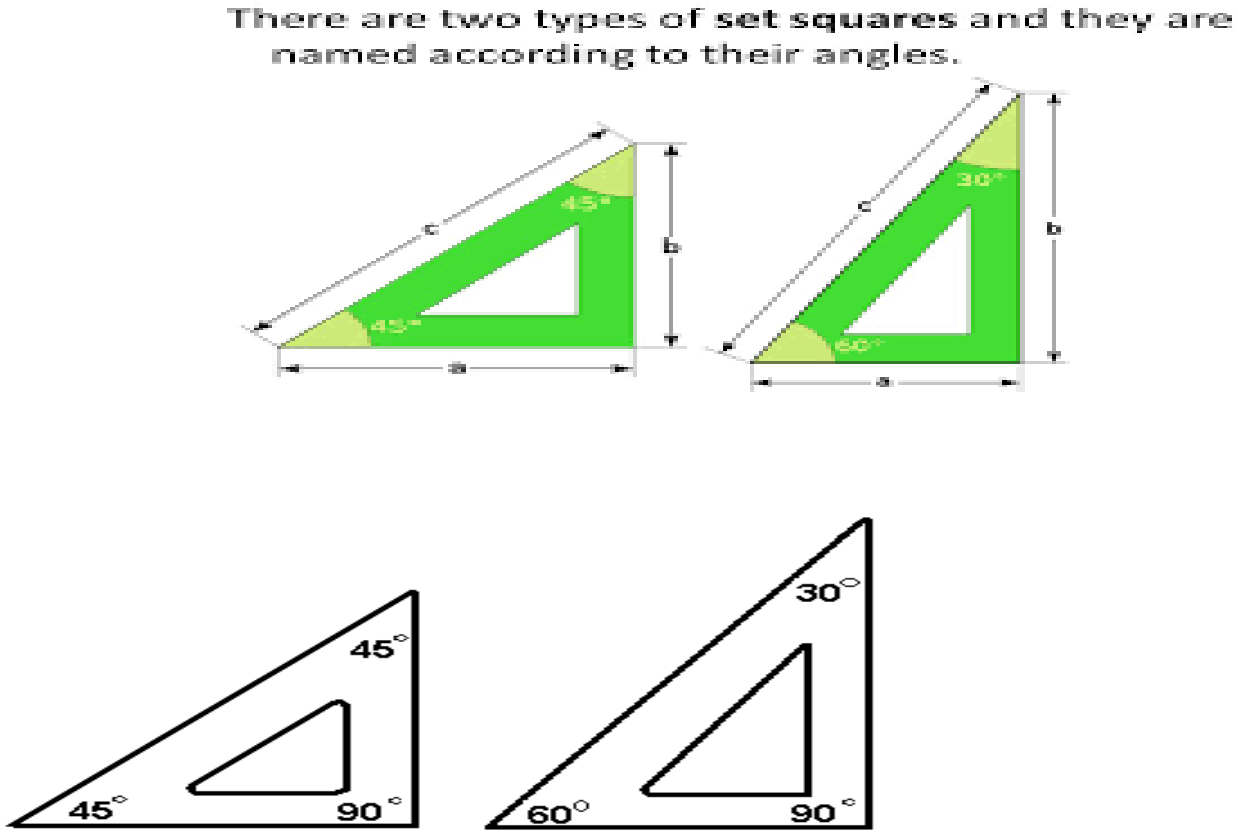


Figure showing types of set squares

- **T-Square**: T-square is a technical drawing instrument used by draftsmen primarily as a guide for drawing horizontal lines on a drafting table. It may also guide a set square to draw vertical or diagonal lines

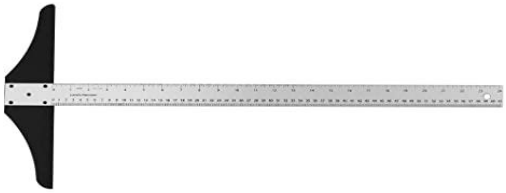
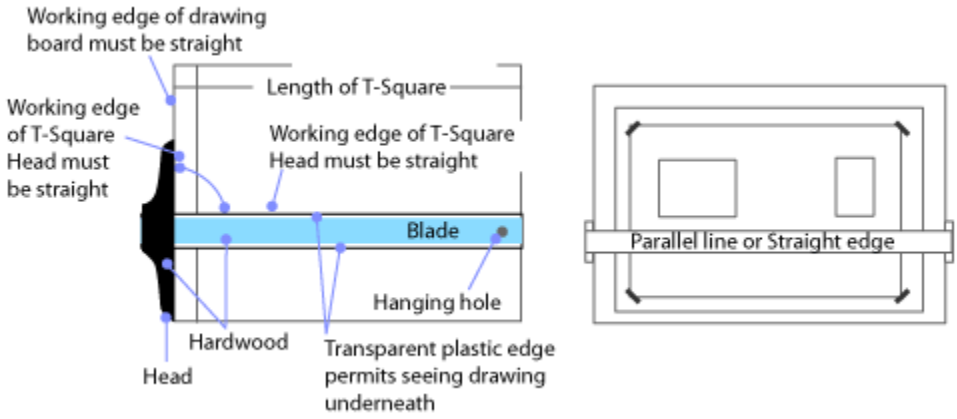


Figure showing T-square

Parts of T-square



Types of T-square

An adjustable T-square to create straight lines at different angles.

a) English T-square. An English T-square for drawing straight lines. ...

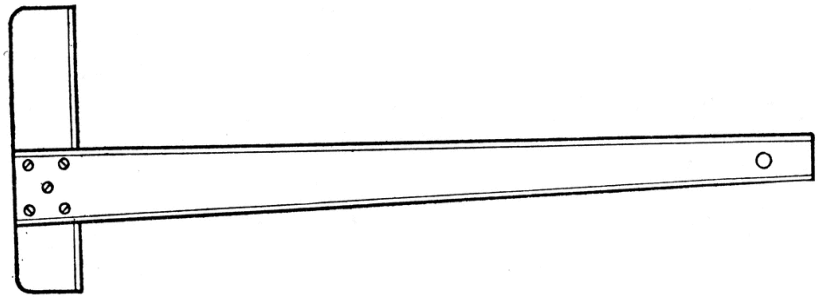


Figure showing English T-square

b) Long Fixed Head T-square. A long fixed head T-square for drawing straight lines. ...

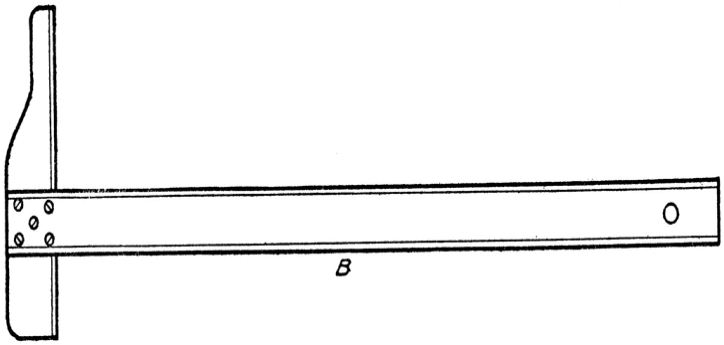


Figure showing Long Fixed Head T-square

c) Regular Fixed Head T-square :For drawing straight lines. The blade must be perfectly straight in order to draw accurate lines.

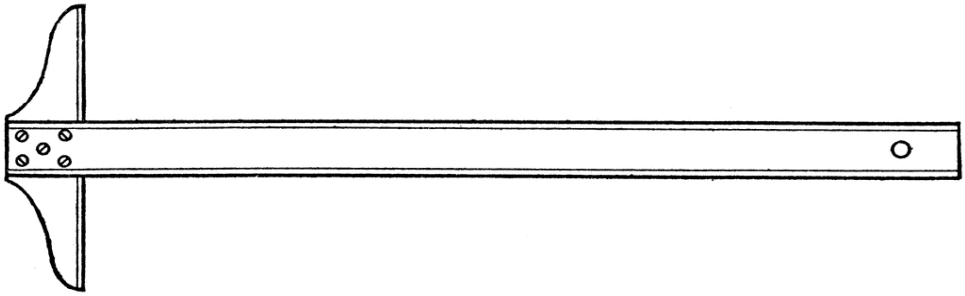


Figure showing Regular Fixed Head T-square

d) Temporary Adjustment T-square squares:can be temporarily **adjusted** by putting the thumb tack in the head as illustrated. This is used when the previous work does not align with the **T-square**.

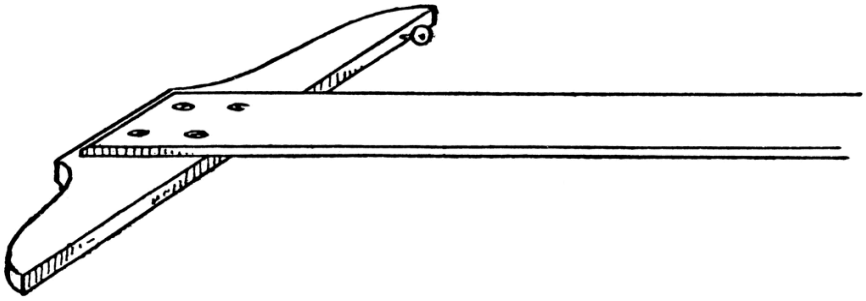


Figure showing Temporary Adjustment T-square squares

- **Angle measurement**

Tools to measure Angles. There are several types of measuring tools that measure angles, and they fall into one of three categories: protractors, squares and compasses. There are many variations of these basic categories.

Protractors. A protractor is the most common device used to measure angles.

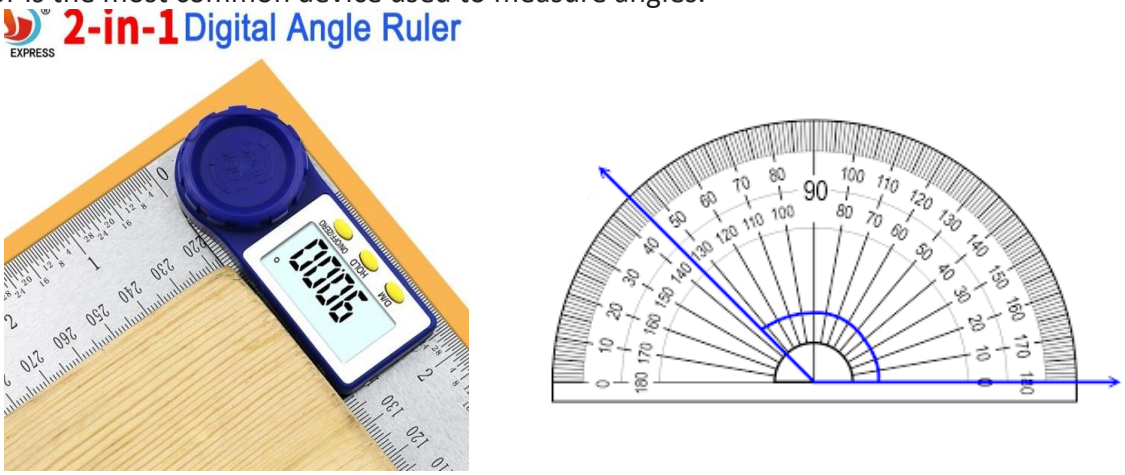


Fig. showing protractor

Content/Topic2(Drawing Equipment)

Equipment most commonly refers to a set of tools or other objects commonly used to achieve a particular objective

1.Drawing table

A drawing board (also drawing table, drafting table or architect's table) is, in its antique form, a kind of multipurpose desk which can be used for any kind of drawing, writing or impromptu sketching on a large sheet of paper or for reading a large format book or other oversized document or for drafting precise

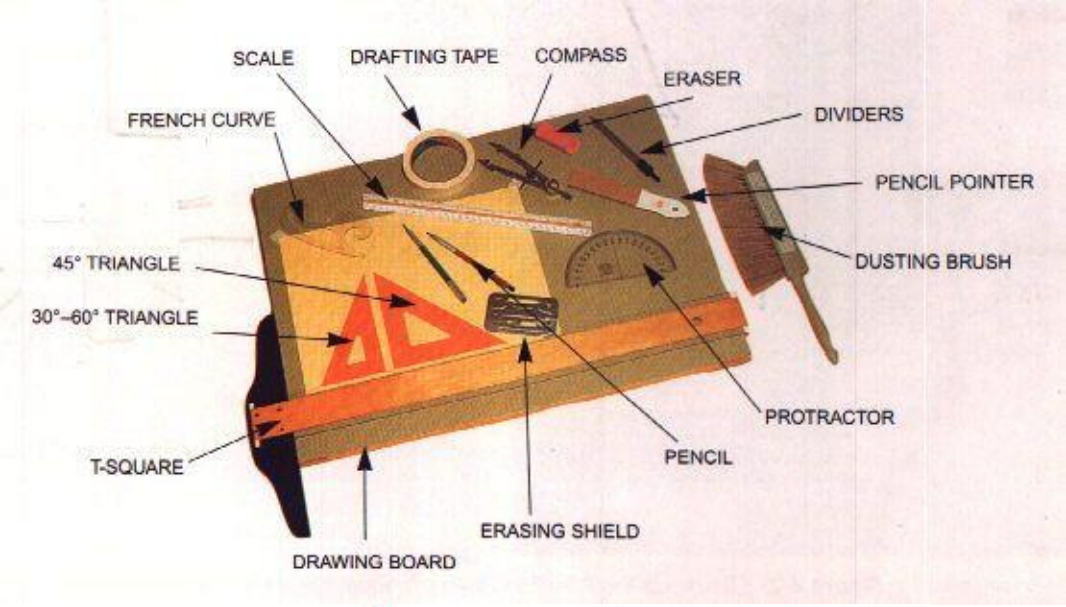


fig. show drawing table

Learning Outcome 1.2: Identify drawing sheets

✔ *Content/Topic 1* Drawing papers

Drawing paper is a paper specially prepared for the use of drawers (such as draftsmen or sketchers)

These are papers that are especially prepared for use in drafting. Cartridge paper - thick white paper for pencil and ink drawings

Paper size standards govern the size of sheets of paper used as writing paper, stationery, cards, and for some printed documents.

The ISO 216 standard, which includes the commonly used A4 size, is the international standard for paper size. It is used across the world except in North America and parts of Central and South America, where North American paper sizes such as "Letter" and "Legal" are used. The international standard for envelopes is the C series of ISO 269.

A Paper Sizes - A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, A10

Size	Width x Height (mm)	Width x Height (in)
4A0	1682 x 2378 mm	66.2 x 93.6 in
2A0	1189 x 1682 mm	46.8 x 66.2 in
A0	841 x 1189 mm	33.1 x 46.8 in
A1	594 x 841 mm	23.4 x 33.1 in
A2	420 x 594 mm	16.5 x 23.4 in
A3	297 x 420 mm	11.7 x 16.5 in
A4	210 x 297 mm	8.3 x 11.7 in
A5	148 x 210 mm	5.8 x 8.3 in
A6	105 x 148 mm	4.1 x 5.8 in
A7	74 x 105 mm	2.9 x 4.1 in
A8	52 x 74 mm	2.0 x 2.9 in
A9	37 x 52 mm	1.5 x 2.0 in
A10	26 x 37 mm	1.0 x 1.5 in

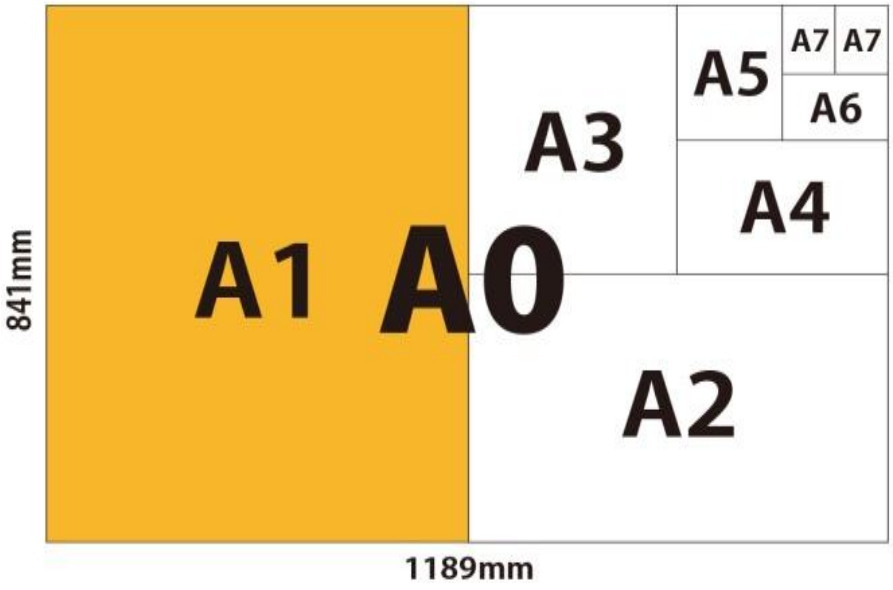


Fig. show size of paper

To obtain paper sizes in centimetres, convert mm values to cm by dividing by 10 and in feet by dividing inch values by 12

Types of drawing sheets:

- **Tracing paper**

Tracing paper: is paper made to have low opacity, allowing light to pass through. ... The transparency of the paper is achieved by careful selection of the raw materials and the process used to create transparency. Cellulose fiber forms the basis of the paper, usually from wood species but also from cotton fiber.

Tracing paper: is a semi-transparent paper you can use to trace an image or drawing. Once you've traced an image onto tracing paper, you can easily transfer it to another piece of paper or even a canvas. Just make sure you're using a graphite pencil so your drawing shows up clearly when you transfer it.

The following Figure show tracing paper

- **Bristol board**

Definition

Bristol board (also referred to as **Bristol paper** or **Super white paper**) is an uncoated, machine-finished paperboard. It is named after the city of Bristol in the southwest of England as that is where it was first produced

APPLICATION

Bristol paper is used for printing documents, brochures, promotional materials and envelopes. It is often used for water color painting. It is also used for paperback book or catalog covers, file folders, tags, and tickets. Another use is for scale models; some students use this kind of paper for the walls in their scale models. One-ply Bristol is thin enough to be translucent, and two and three ply bristol are the most popular thicknesses.

Bristol board is commonly used for technical drawing, illustration projects, comic book art, and other two-dimensional art forms. It provides two working surfaces, front and back. This quality separates it from illustration board, which has only a front working surface.

The Following Figure ShowBristol Paper

- **Normal sheets**

Is standards govern the size of sheets of paper used as writing paper, stationery, cards, and for some Printed documents.

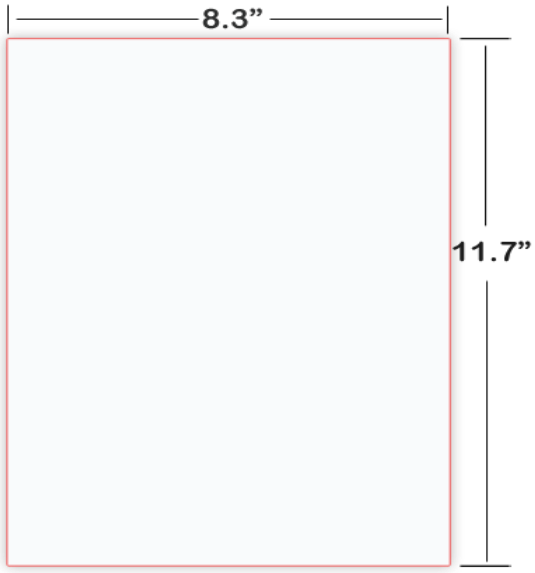


Fig show normal sheet

Learning Unit 2. Use hand draft drawing

Learning Outcome 2.1:Sketch Plumbing symbols.

- Content/Topic 1 (Types of drawing symbols)
    - **Basic symbols**: A **symbol** is a mark, sign, or word that indicates, signifies, or is understood as representing an idea, object, or relationship. Symbols allow people to go beyond what is known or seen by creating linkages between otherwise very different concepts and experiences

Plumbing

Contains plumbing components and bathroom fixtures for diagrams, blueprints, or schematics of waste water disposal systems, hot and cold water supply systems, and piping systems.

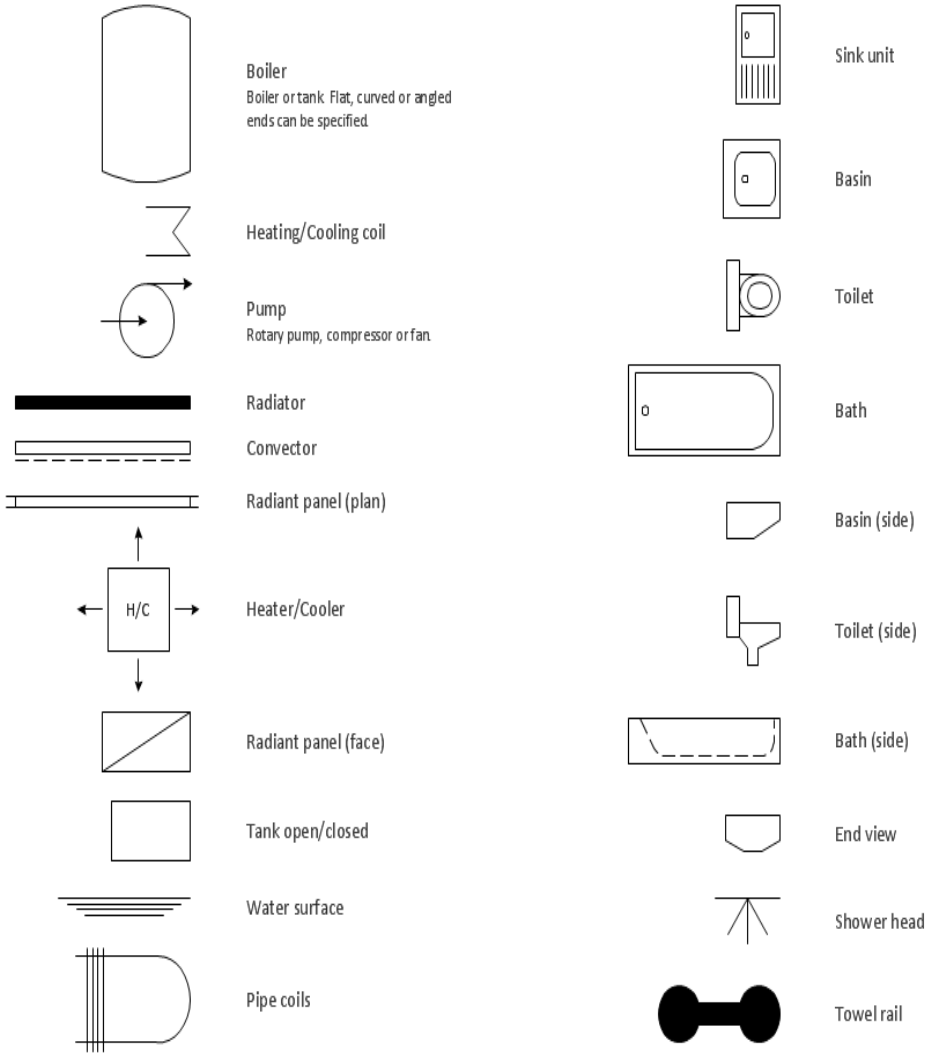


Fig showing basic symbols used in pipe work drawing

- **General symbols**: A **symbol** is a mark, sign, or word that indicates, signifies, or is understood as representing an idea, object, or relationship in general.

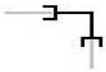
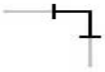
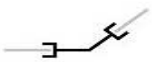
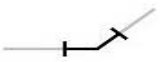
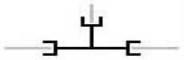
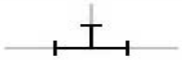
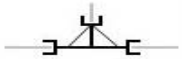
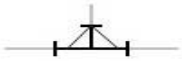
Image	Fittings	Butt weld Symbol	Socket Weld Symbol	Threaded Symbol	Fittings	Image
	Elbow 90°				Elbow 90°	
	Elbow 45°				Elbow 45°	
	Tee equal				Tee equal	
	Tee reducing				Tee reducing	
	Cap				Cap	

Fig showing general symbols used pipe work drawing

Learning Outcome 2.2: Sketch views and sections

- *Content/Topic 1 (*Different views of plumbing features)

A **plumbing fixture** is an exchangeable device which can be connected to a plumbing system to deliver and drain water.

The most common plumbing fixtures are:

1. **Bath -tub**

A bath-tub or **bath** is a container for holding water in which a person or animal may bathe.

A bath-tub is usually placed in a bath-room either as a stand-alone fixture or in conjunction with a shower

Left Side view of bathtub

Top side view of bathtub

Right side view of bath

Front view of bathtub

2D of bath-tub


3D of bath-tub


2. **Bidet**

It is a bowl or receptacle designed to be sat on for the purpose of washing the human genitalia (mainly female genitalia), perineum, inner buttocks, and anus. The modern variety includes a plumbed-in water supply and a drainage opening, and is thus a type of plumbing fixture subject to local hygiene regulations. The bidet is designed to promote personal hygiene, and is used after defecation, and before and after sexual intercourse

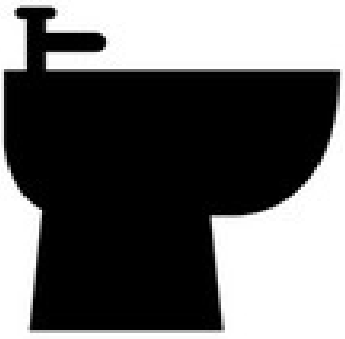



Fig show bidets

Fig show top view of bidet

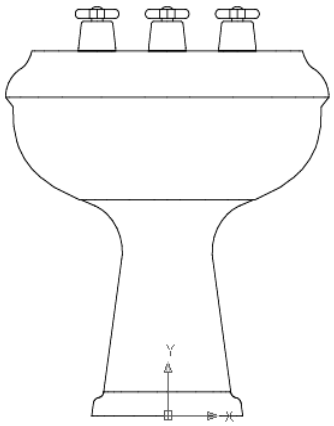


Fig show front view of bidet

3. **Channel drains**

Is a specific type of floor drain containing a dominant trough- or channel-shaped body. It is used for the rapid evacuation of surface water or for the containment of utility lines or chemical spills.

Employing a solid cover or grating that is flush with the adjoining surface, this drain is commonly made of concrete in-situ and may utilize polymer- or metal-based liners or a channel former to aid in channel crafting and slope formation. Characterized by its long length and narrow width, the cross-section of the drain is a function of the maximum flow volume anticipated from the surrounding surface.

Channels can range from 1 inch (25 mm) to 2 feet in width, with depths that can reach 4 feet (120 cm).

Trench drains are commonly confused with French drains, which consist of a perforated pipe that is buried in a gravel bed, and which is used to evacuate ground water.

A slot drain, also wrongly associated with a trench drain, consists of a drainage pipe with a thin neck (or slot) that opens at the ground surface with sufficient opening to drain storm water.

Fig show drain chain

4.Drinking fountain

A drinking fountain, also called a water fountain or bubbler, is a fountain designed to provide drinking water.

Fig show Drinking fountain

5.Hose bib (connections for water hoses)

A hose bib, also called a sill cock or simply a hose spigot, is the outdoor water tap on the exterior of your home. This spigot has a threaded spout that allows the homeowner to connect a garden hose for outdoor water use.

Fig showa hose bib

6. Janitor sinks

Janitorial sinks include utility and service sinks, as well as mop sinks and sink cabinets. Designed to make janitorial and cleaning duties go more smoothly.

All janitorial sinks are built to withstand the rigors of heavy-duty cleaning, mopping and constant usage.

Fig show Janitor sinks

7. **Kitchen sinks**

Is a fitting material used for washing dishes and preparing food.

Fig show Kitchen sinks

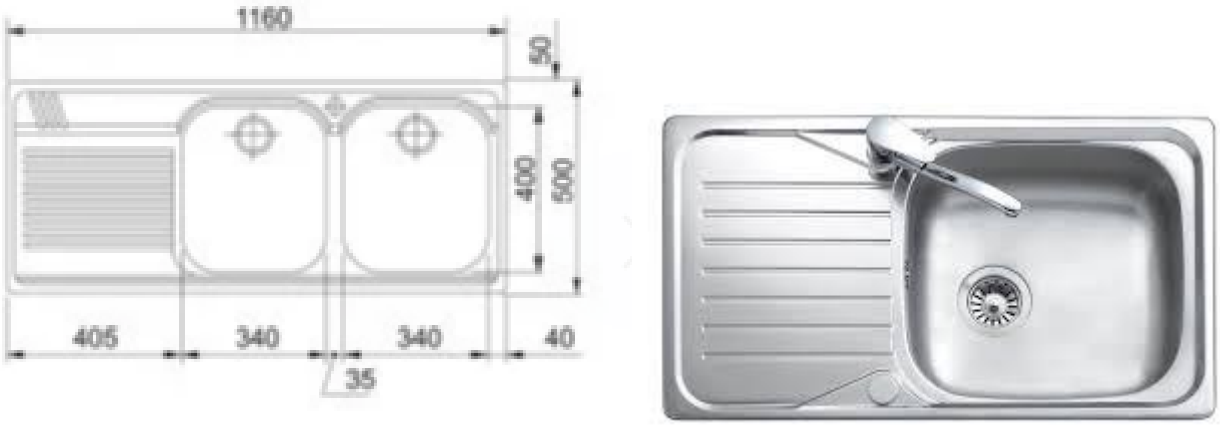
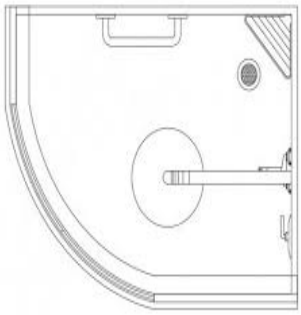


Fig show top view of Kitchen sinks

8. Showers

A shower is a place in which a person bathes under a spray of typically warm or hot water. Indoors, there is a drain in the floor. Most showers have temperature, spray pressure and adjustable showerhead nozzle.

Fig showing shower



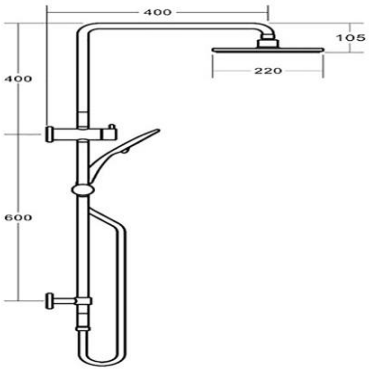


Fig show Top view of shower **fig show right side view of shower**

9. Pipes

A pipe is a tubular section or hollow cylinder, usually but not necessarily of circular cross-section, used mainly to convey substances which can flow — liquids and gases, slurries, powders and masses of small solids.

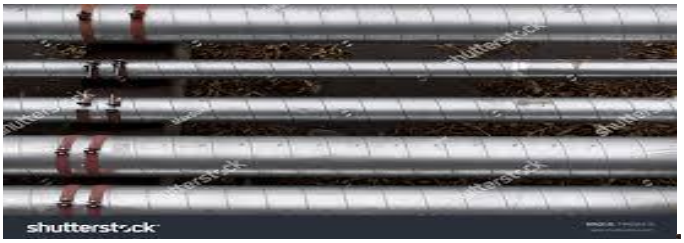


Fig showing right side view of pipes

fig show front view of pipe

top view of a pipe

10.Tap ware

In industry term for that sub-category of plumbing fixtures consisting of tap valves, also called water taps (British English) or faucets (American English), and their accessories, such as water spouts and shower heads.

Fig showing tap ware

11. Terminal valves

It s a type of fitting that allows for regulation, control, and direction of fluids passing through apipe. Valves are commonly used to direct flow, shut off water access, prevent backflow, and adjust water pressure within a system.

12. Urinals

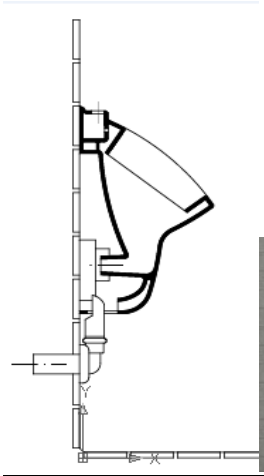
A urinal is a sanitary plumbing fixture for urination only. Urinals are often provided in public toilets for male users in Western countries (less so in Muslim countries).

They are usually used in a standing position. Urinals can be with manual flushing, automatic flushing, or without flushing, as is the case for waterless urinals.

They can be arranged as single sanitary fixtures (with or without privacy walls) or in a trough design without privacy walls. Urinals designed for females ("female urinals") also exist but are rare. It is possible for females to use male urinals with a female urination device.

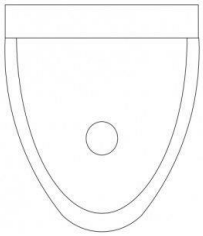
The term "urinal" may also apply to a small building or other structure containing such fixtures. It can also refer to a small container in which urine can be collected for medical analysis, or for use where access to toilet facilities is not possible, such as in small aircraft, during extended stakeouts, or for the bedridden.

A bowl or other receptacle, typically attached to a wall in a public toilet, into which men may urinate.



Cross section of urinal

Front view



Top view of urinal

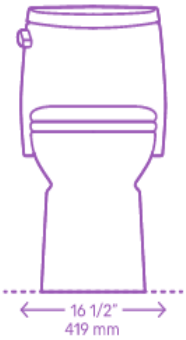
13. Utility sinks

The utility sinks have one to four compartments, with three-compartment sinks being the most common for washing, and sanitizing dishes.

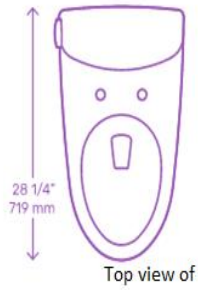
Fig show a sinks

1. **Flush toilets**

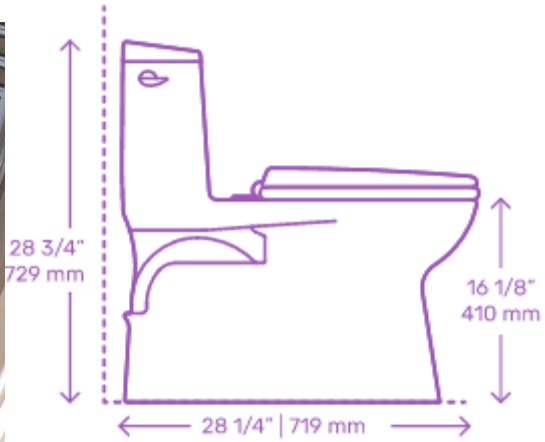
A flush toilet (also known as a flushing toilet, water closet (WC) – see also toilet names) is a toilet that disposes of human waste (urine and feces) by using water to flush it through a drainpipe to another location for disposal, thus maintaining a separation between humans and their waste. Flush toilets can be designed for sitting (in which case they are also called "Western" toilets) or for squatting, in the case of squat toilets.



Front view of flush toilet



Top view of flush toilet



Right side view

- ✔ **Top side view**

What you see when you look at something from directly above. Here is a top view of a camera. Also called a Plan View.

- ✔ **Left side view**

The left-side view, the observer looks towards the left. But the side that he sees if he looks towards the left is the right-side of the object.

- ✔ **Right side view**

The right side view is projected onto the profile plane of projection, which is a plane that is parallel to the right side of the object.

- ✔ **Front view**

A front view is a projection view obtained by drawing perpendiculars from all points on the edges of the part to the plane of projection. The plane of projection upon which the front view is projected is called the frontal plane. Projecting points from 3D.

✔ **2D**

A 2D projection (or graphical projection) is a design technique used to display a two-dimensional of an object

✔ **3D**

A 3D projection (or graphical projection) is a design technique used to display a three-dimensional (3D) object on a two-dimensional (2D) surface. These projections rely on visual perspective and aspect analysis to project a complex object for viewing capability on a simpler plane.

- **Different types of sections**

✔ **Longitudinal section**

A section that is cut along the long axis of a structure. Longitudinal section is the opposite of cross-section

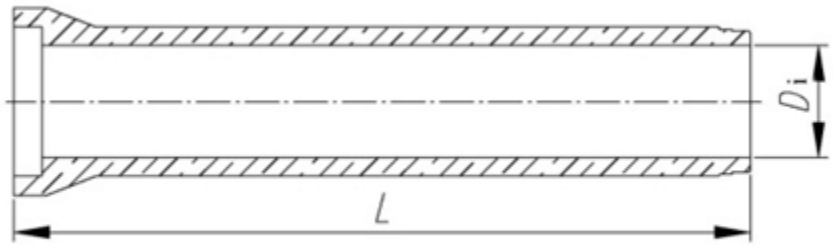
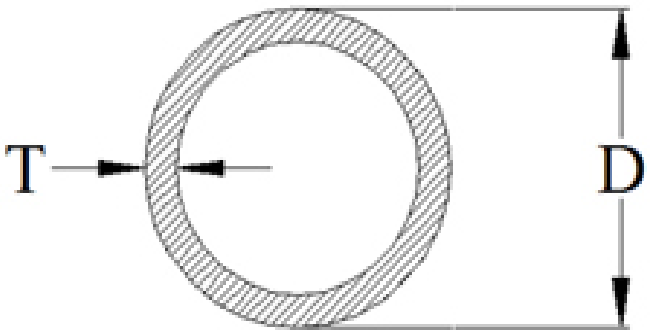


fig show Longitudinal section of pipe

✔ **Transversal section (cross section)**

A cross-section, being a projection of an object onto a plane that intersects it, is a common tool used to depict the internal arrangement of a 3-dimensional object in two dimensions.

It is traditionally crosshatched with the style of crosshatching often indicating the types of materials being used.



Cross section of pipe

Learning Unit 3: Perform scale drawing

Learning Outcome 3.1: Draw plumbing symbols

Content/Topic 1 (Types of scales)

Scale:

Means the proportion or ratio between the dimensions adopted for the drawing and the corresponding dimensions of the object.

Types of scales

Representing scales: The proportion between the drawing and the object can be represented by **two** ways as follows**:**

a) Scale: - 1cm = 1m or 1cm=100cm or 1:100

b) Representative Fraction: - (RF) = 1/100 (less than one) i.e. the ratio between the size of the drawing and the object.

There are **three** types of scales depending upon the proportion it indicates as

1. Reducing scale: When the dimensions on the drawing are smaller than the actual dimensions of the object. It is represented by the scale and RF as

Scale: - 1cm=100cm or 1:100 and by RF=1/100 (less than one)

2. Full scale: Sometimes the actual dimensions of the object will be adopted on the drawing then in that case it is represented by the scale and RF as

Scale: - 1cm = 1cm or 1:1 and by R. F=1/1 (equal to one).

3. Enlarging scale: In some cases, when the objects are very small like inside parts of a wrist watch, the dimensions adopted on the drawing will be bigger than the actual dimensions of the objects then in that case it is represented by scale and RF as

Scale: - 10cm=1cm or 10:1 and by R. F= 10/1 (greater than one)

Note: The scale or R.F of a drawing is given usually below the drawing. If the scale adopted is common for all drawings on that particular sheet, then it is given commonly for all figures under the title of sheet.

1.2. Types of Scales and their constructions:

When an unusual proportion is to be adopted and when the readymade scales are not available then the required scale is to be constructed on the drawing sheet itself. To construct the scale, the data required is:

1) the R.F of the scale

2) The units which it has to represent i.e. millimeters or centimeters or meters or kilometers in M.K.S or inches or feet or yards or miles in F.P.S) The maximum length which it should measure. If the maximum length is not given, some suitable length can be assumed.

The maximum length of the scale to be constructed on the drawing sheet =

R.F X maximum length the scale should measure.

This should be generally of 15 to 20 cms length.

Table: Metric Units Table: FPS Units

1 Kilometre (km) =10 Hecta metres (hm)	1 Mile =8 Furlongs
1 Hectametere(hm) =10 Decametres(dam)or 0.1km	1 Furlong =220 Yards
1 Decametre(dam) =10 Metres (m) or 0.1hm	1Yard =3 Feet
1 Metre(m) =10Decimetres(dm) or 0.1dam	1 Feet =12 Inches
1 Decimetre(dm) =10 Centimetres(cm) or 0.1m	

1 Centimetre(cm) =10 Millimetres (mm) or 0.1dm

The various types of **scales** used in practice are

1. Plain scales,

2. Diagonal scales,

3. Vernier scales,

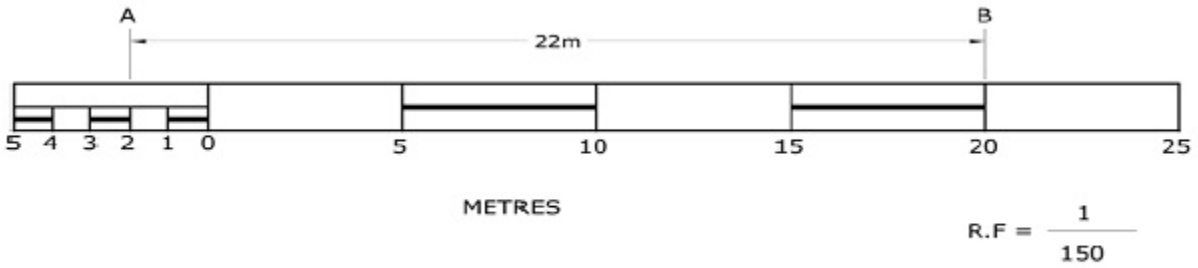
4. Comparative scales and

5. Scale of chords.

Plain Scales: Plain scales read or measure upto **two** units or a unit and its sub-division, for example centimetres (cm) and millimetres (mm). When measurements are required upto first decimal, for example 2.3 m or 4.6 cm etc. It consists of a line divided into number of equal main parts and the first main part is sub-divided into smaller parts. Mark zero (O) at the end of the first main part. From zero mark numbers to the main parts or units towards right and give numbers to the sub-divisions or smaller parts towards left. Give the names of the units and sub-units below clearly. Indicate below the name of the scale and its R.F clearly.

The construction of the plain scale is explained below by a worked example.

A 3 cm long line represents a length of 4.5 metres. Extend this line to measure upto 30 metres and show on it units of metre and 5 metre. Show the length of 22 metres on this line. Fig bellow



i) The scale has to represent metre and 5 metres, hence it is a Plain scale.

ii) Given that 3cm represents 4.5metres or 450cm, Hence 1cm represents 450/3=150cm, hence scale is 1cm=150cm or 1:150: R.F=1/150

iii) Maximum length to read is 30metres; Length of the scale is 20cm. i.e. (1/150)x30x100 = 20cm

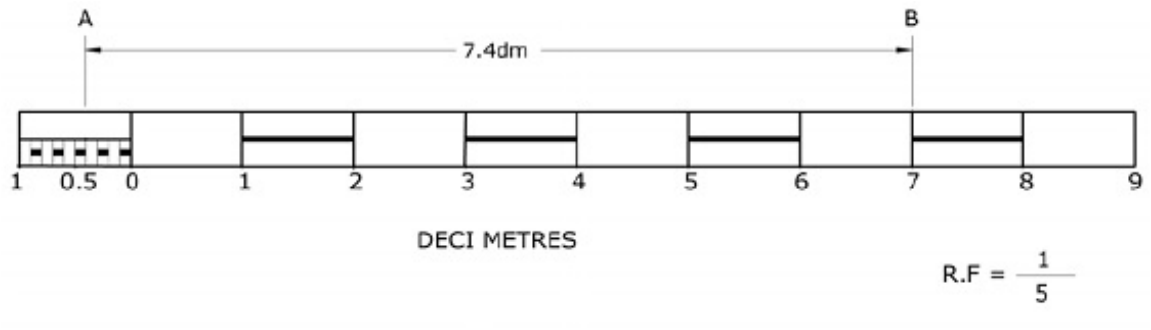
Construction:

Draw a straight line of 20cm length and divide into 6 equal parts.

Divide again first part into 5 equal parts. Give numbers as shown. To represent 22 metres, take 4 main parts to represent 20 metres and 2 small parts to represent 2metres. Give names as A and B so that the distance between A and B is 22 metres as shown.

Note: Assume height of the plain scale as 1 cm.

Construct a plain scale of 1:5 to show decimeters and centimeters and to read upto 1 metre. Show the length of 7.4 decimetres on it.

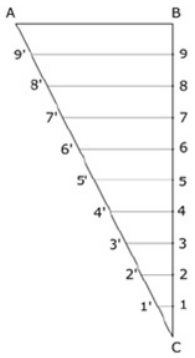


i) The scale has to represent Decimetre and 1/10 of decimeter.
ii) Given that the scale is 1:5 that is R. F=1/5
iii) Maximum length to read is 1 Metre; Length of the scale= (1/5) x1x100=20cm

Construction:
Draw a straight line of 20cm length and divide into 10 equal parts.
Divide again first part into 10 equal parts. Give numbers as shown. To represent 7.4 decimetres, take 7 main parts to represent 7 decimetres and 4 small parts to represen0t 0.4 decimetres. Give names as A and B so that the distance between A and B is 7.4 decimetres as shown.

2. Diagonal Scales:

Diagonal scales are used to read or measure upto three units.
For example: decimetres (dm), centimetres (cm) and millimetres (mm) or miles, furlongs and yards etc. This scale is used when very small distances such as 0.1 mm are to be accurately measured or when measurements are required upto second decimal.
For example: 2.35dm or 4.68km etc.
Small divisions of short lines are obtained by the principle of diagonal division, as explained below:
Principle of diagonal scale: To divide a given line AB into small divisions in multiples of 1/10 its length for example 0.1AB; 0.2AB etc. as shown in



Procedure:
i) Draw AB of given length

ii) At one end, say at B draw a line perpendicular to AB.
iii) Mark 10 equal divisions by taking some convenient length starting from B and ending with C.
iv) Give numbers from 9, 8, 7----1 as shown.
v) Join C to A and from 9 to 1, draw parallels to AB, cutting AC at 9', 8', ------ 1' etc.
vi) From the similar triangles 1'1C, 2'2C ------- 9'9C and ABC, C5= (1/2) BC=0.5BC and 5'5= (1/2) AB=0.5AB. Similarly, 1'1=0.1AB, 2'2=0.2AB etc

Thus each horizontal line below AB will be shorter by (1/10)AB, giving lengths in multiples of 0.1AB.

- Content/Topic 2 (Some abbreviation used in pipe work drawing)

NV: Needle valve is a type of valve with a small port and a threaded, needle-shaped plunger. It allows precise regulation of flow, although it is generally only capable of relatively low flow rates.
CSO: Car Seal Open are a simple device used to lock or 'seal' a valve in the open or closed position to prevent unauthorized operation of the valve. Valve operation can only take place by cutting the seal, thereby giving evidence of either tampering, or activity by an authorized worker.
CSC: Car Seal Closed are a simple device used to lock or 'seal' a valve in the open or closed position to prevent unauthorized operation of the valve. Valve operation can only take place by cutting the seal, thereby giving evidence of either tampering, or activity by an authorized worker.
LO: Lock OpenA valve is termed "Lock Open" when it is required by the applicable code, safety protocols or standard operating conditions
LC: Lock Closed is a restriction of, or complete stoppage of liquid flow caused by vapour trapped in a high point of a liquid-filled pipe system. The gas, being less dense than the liquid, rises to any high points. This phenomenon is known as vapour lock, or air lock.
SC: Sample Connectionmeans an assembly of equipment within a process or waste management unit used during periods of representative operation to take samples of the process or waste fluid
PO:Pump Out is to produce (something) quickly and frequently
SO:Steam Outdeal successfully with difficult situation or job
FO:Furnished by others
DF: Drain Funnel The funnel prevents splashing and directs the waste into the drain. ... The funnel is attached to the grate by means of concealed screws and it may be moved to any grate location desired.
WC: Water Closet

Content/Topic 3 (Drawing of different types of plumbing symbols on scale)

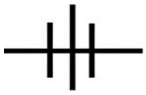
1. **Plumbing Symbols: What They Mean**

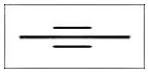
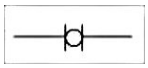
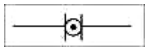
Plumbing symbols are used when drawing house plans and diagrams. The purpose of these symbols is to indicate where the different elements of your plumbing system are located. Some of these symbols are self-explanatory, but others might be more difficult to interpret.

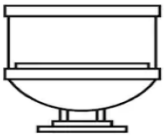
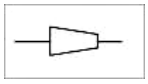
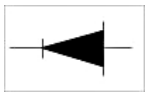
Here is what the most common symbols used in plumbing diagrams mean.

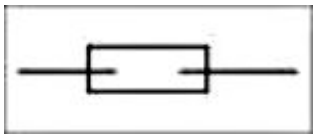
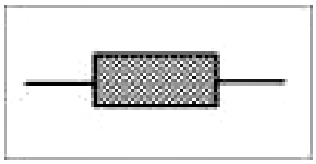
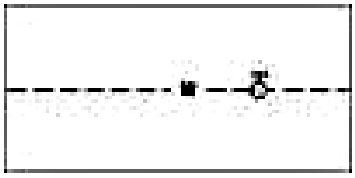
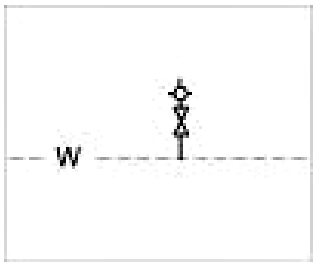
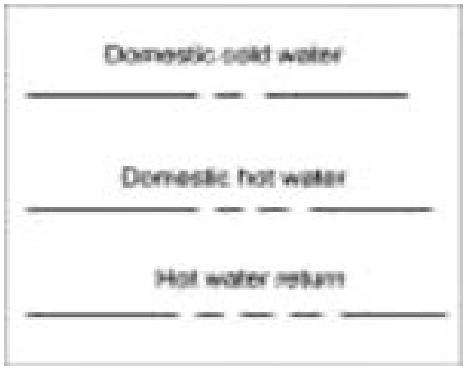
1.1. Plumbing pipe and fitting symbols

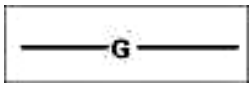
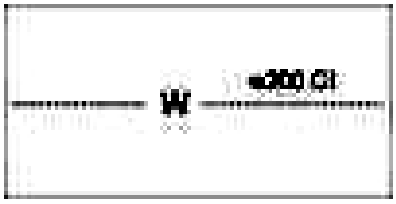
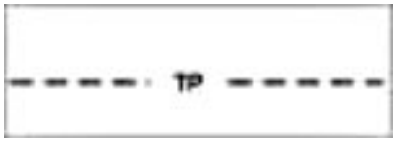
There are more than 200 plumbing pipe and fitting symbols that're used on P&IDs (piping and instrument diagrams). That is many more than we can cover here individually, but we will cover some of the basics.

Symbol	Name	Real World Example
	90 Deg Elbow	
	Cap symbol	
	Wye symbol	
	45 deg elbow	
	Union symbol	
	Vent symbol	
	P-trap symbol	

	Tee symbol	
	Running trapsymbol	
	Pipe going down symbol	
	Pipe going up symbol	
	Pipe guide symbol	
	Pipe tee up symbol small	
	Pipe cross UP DOWN symbol	

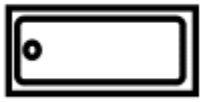
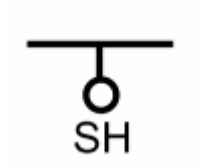
WC	Water closet symbol	
FD	Floor drain symbol	
KS	Kitchen sink symbol	
LAV	Lavatory symbol	
LT	Laundry tray symbol	
	Bushing symbol	
	Concentric reducer symbol	
	Eccentric reducer symbol	

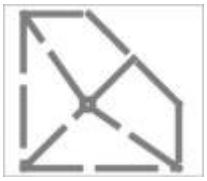
	Expansion joint symbol	
	Flexible connection symbol	
	Curb stop symbol	
	Fire hydrant & isolation valve symbol	
	Compressed air line symbol	
	Domestic cold water Domestic hot water Hot water return/ recirculating	

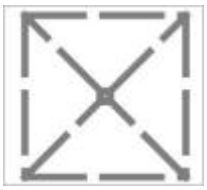
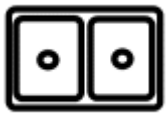
	Gas line symbol	
	Water main symbol with size and type of pipe	
	Trap primer symbol	
	Floor drain round symbol	
	Floor drain square symbol	
	Funnel floor drain symbol small	
	Funnel drain elevation symbol	

	Hub drain symbol	
	Roof drain symbol	

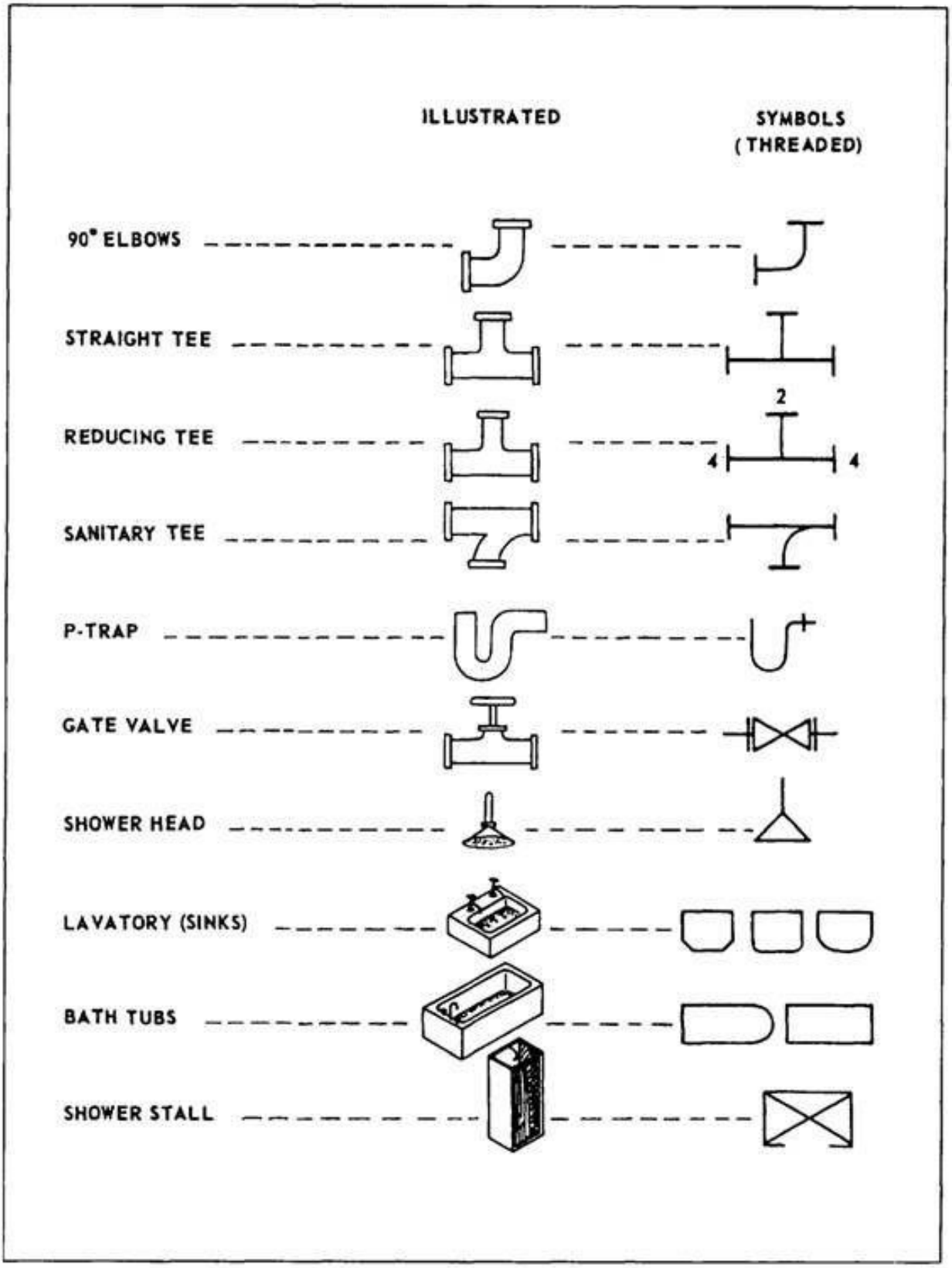
Plumbing fixture symbols

Symbol	Name	Real World Example
	Bathtub	
	Handicap lavatory	
	Urinal type 2	
	Shower head	

	Corner Shower symbol	
	Wash fountain symbol	
	Bidet	
	Oval lavatory symbol – type 2	
	Wall hung water closet (toilet)	
	Hot water tank	

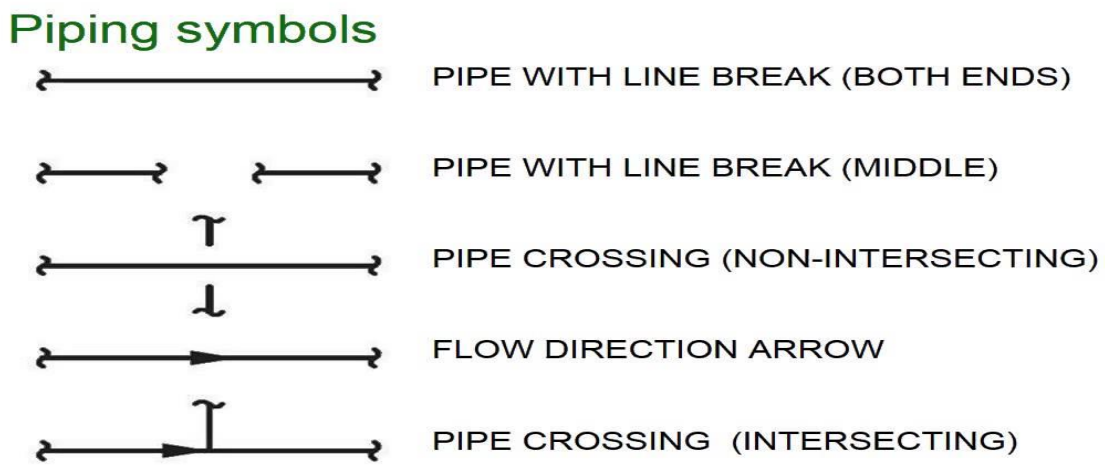
	Shower stall symbol	
	Wash fountain semi-circle symbol	
	Eye wash symbol	
	Drinking fountain	
	Water closet (toilet) symbol – type 1	
	Single bowl sink	
	Double compartment sink	

	Handicap lavatory	
	Urinal type 1	
	Eye wash symbol – type 2	

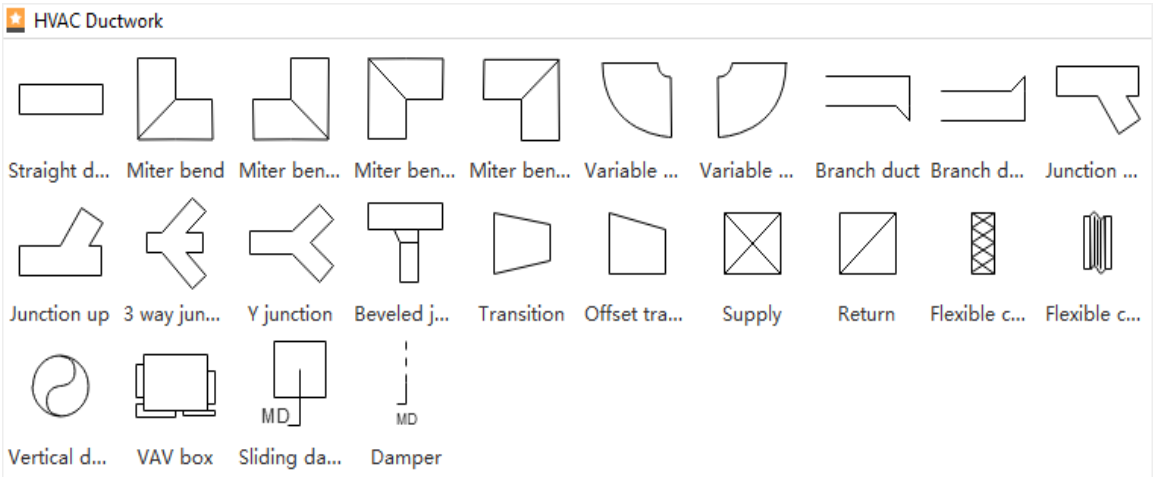

ILLUSTRATED
SYMBOLS
(THREADED)
90° ELBOWS
STRAIGHT TEE
REDUCING TEE
2
4
4
SANITARY TEE
P-TRAP
GATE VALVE
SHOWER HEAD
LAVATORY (SINKS)
BATH TUBS
SHOWER STALL

✔ **Basic symbols**

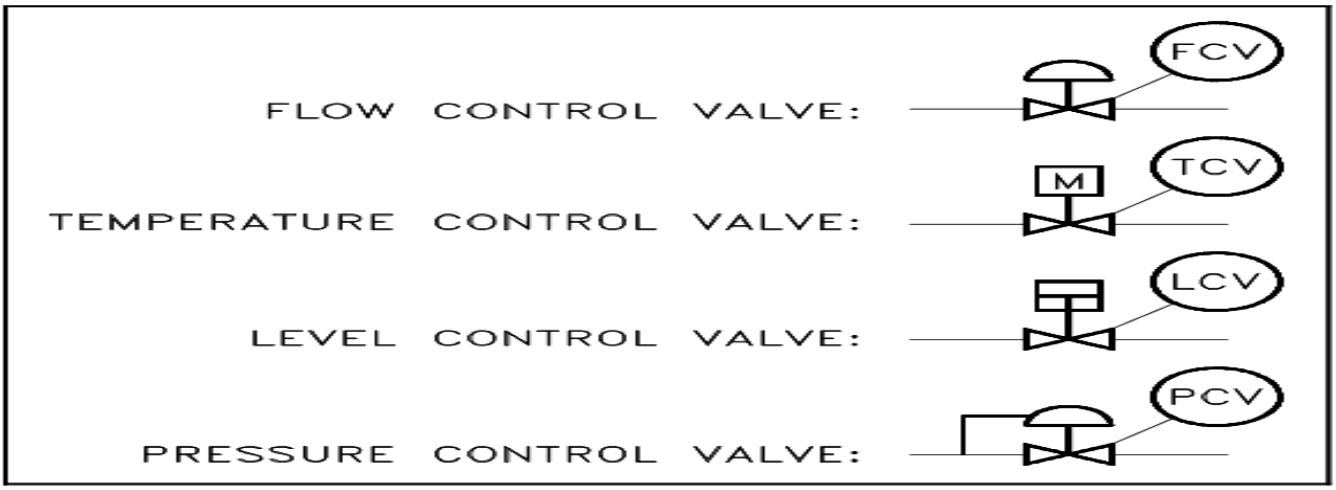
- **Pipes**

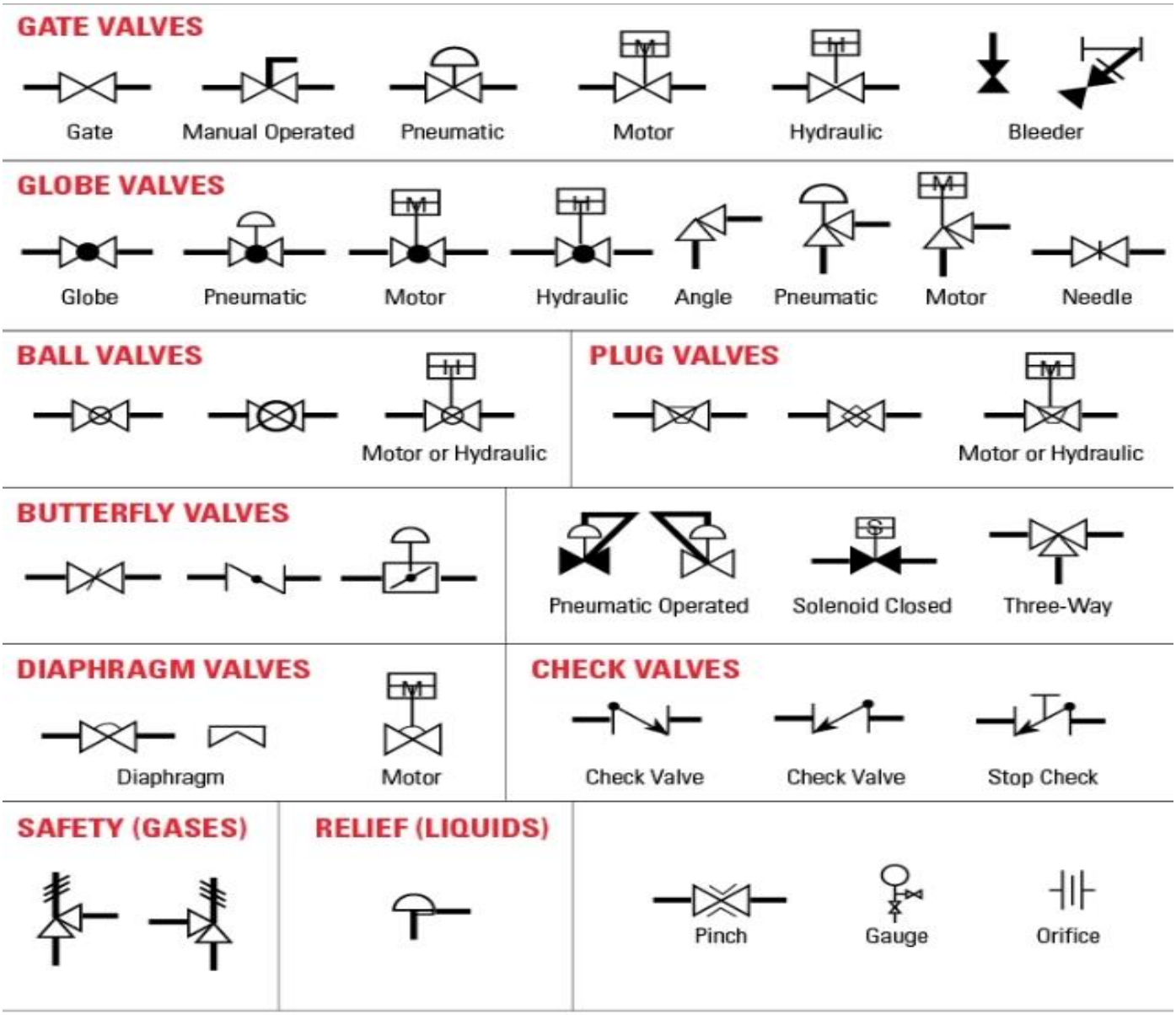


- **Ducts symbols**



Control valves symbols


FLOW CONTROL VALVE:
FCV
TEMPERATURE CONTROL VALVE:
M
TCV
LEVEL CONTROL VALVE:
LCV
PRESSURE CONTROL VALVE:
PCV


GATE VALVES
Gate
Manual Operated
Pneumatic
Motor
Hydraulic
Bleeder
GLOBE VALVES
Globe
Pneumatic
Motor
Hydraulic
Angle
Pneumatic
Motor
Needle
BALL VALVES
Motor or Hydraulic
PLUG VALVES
Motor or Hydraulic
BUTTERFLY VALVES
Pneumatic Operated
Solenoid Closed
Three-Way
DIAPHRAGM VALVES
Diaphragm
Motor
CHECK VALVES
Check Valve
Check Valve
Stop Check
SAFETY (GASES)
RELIEF (LIQUIDS)
Pinch
Gauge
Orifice

- **Apparatus with rotating parts**

Rotating equipment induces stress on the piping connected to it due to the rotational force it generates. ... It must be possible to shut down all rotating equipment both remotely and with a manual

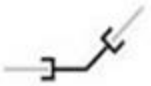
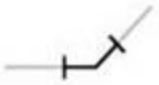
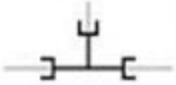
- Apparatus without rotating parts

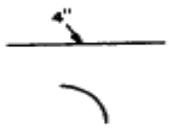
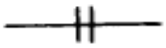
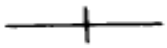
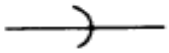
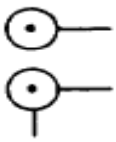
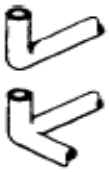
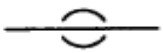
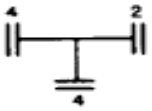
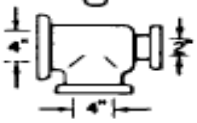
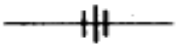
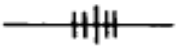
✔ General symbols

- **Branching pipes Symbols**

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

Branching pipes symbols

Image	Fittings	Butt weld Symbol	Socket Weld Symbol	Threaded Symbol	Fittings	Image
	Elbow 90°				Elbow 90°	
	Elbow 45°				Elbow 45°	
	Tee equal				Tee equal	
	Tee reducing				Tee reducing	
	Cap				Cap	

ITEM	SYMBOL	SAMPLE APPLICATION (S)	ILLUSTRATION
PIPE	SINGLE LINE IN SHAPE OF PIPE— USUALLY WITH NOMINAL SIZE NOTED		
JOINT— FLANGED	DOUBLE LINE		
SCREWED	SINGLE LINE		
BELL AND SPIGOT	CURVED LINE		
OUTLET TURNED UP	CIRCLE AND DOT		
OUTLET TURNED DOWN	SEMICIRCLE		
REDUCING OR ENLARGING FITTING	NOMINAL SIZE NOTED AT JOINT		
REDUCER CONCENTRIC	TRIANGLE		
ECCENTRIC	TRIANGLE		
UNION SCREWED	LINE		
FLANGED	LINE		

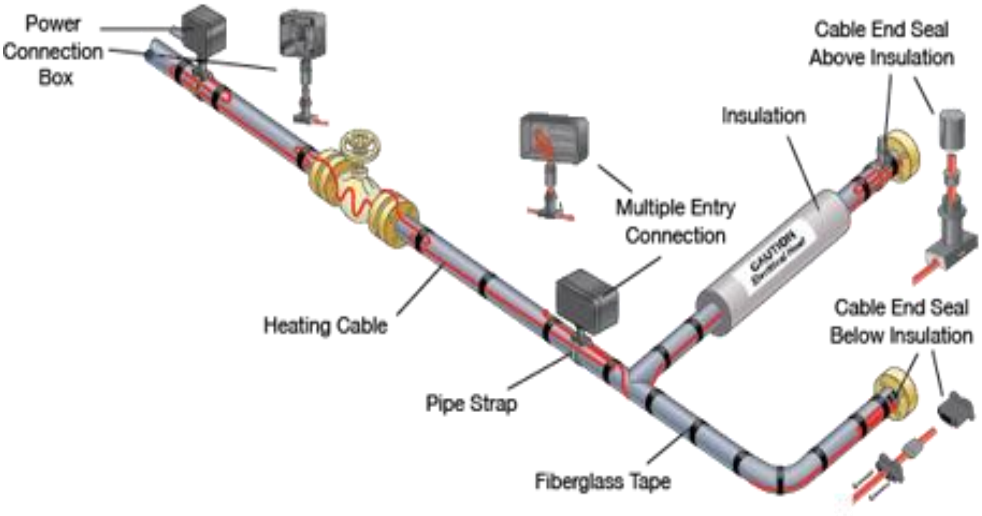
- **Flexible pipes**

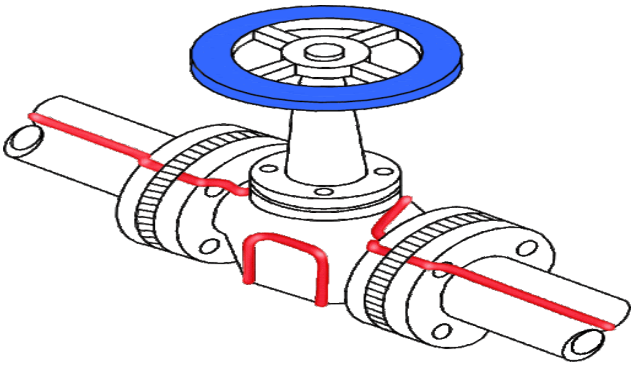
A **flexible pipe** is made up of several different layers. The main components are leak proof thermoplastic barriers and corrosion-resistant steel wires. ... In addition, **flexible pipe** can be easily retrieved to be reused on another field development or for decommissioning.

- **Flexible pipes symbols**

- **Tracer heater pipes**

is a system used to maintain or raise the temperature of pipes and vessels using heat tracing cables. Trace heating takes the form of an electrical heating element run in physical contact along the length of a pipe. The pipe is usually covered with thermal insulation to retain heat losses from the pipe

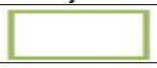




- **Direction of flow**

Flow direction determines which **direction** water will **flow** in a given cell. Based on the **direction** of the steepest descent in each cell

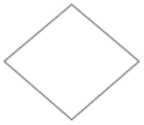
- **Direction of flow symbols**

Name	Symbol	Description
Process		Process or action step
Flow line		Direction of process flow
Start/ terminator		Start or end point of process flow
Decision		Represents a decision making point
Connector		Inspection point
Inventory		Raw material storage
Inventory		Finished goods storage
Preparation		Initial setup and other preparation steps before start of process flow
Alternate process		Shows a flow which is an alternative to normal flow
Flow line(dashed)		Alternate flow direction of information flow

Design Elements - Cross-Functional Flowcharts solution - Flowcharts Shapes

Process
Any processing function.

Terminator
Indicates the beginning or end of a program flow in your diagram.



Decision
Decision point between two or more paths in your flowchart.

Document
Data that can be read by people, such as printed output.

Data
Can represents any type of data in a flowchart.

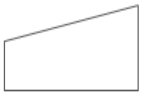
Predefined Process
A named process, such as a subroutine or a module.

Stored Data
Any type of stored data.

Internal Storage
An internal storage device.

Sequential Data
Data that is accessible sequentially, such as data stored on magnetic tape.

Direct Data
Data that is directly accessible, such as data stored on disk drives.



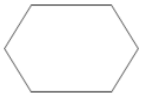
Manual Input
Data that is entered manually, such as with a keyboard or barcode reader.

Card
Data that is input by means of cards, such as punch cards or mark-sense forms.

Paper Tape
Data that is stored on paper tape.

Display
Data that is displayed for people to read, such as data on a monitor or projector screen.

Manual Operation
Any operation that is performed manually (by a person).



Preparation
A modification to a process, such as setting a switch or initializing a routine.

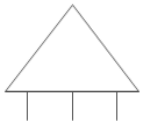
Parallel Mode
Indicates the synchronization of two or more parallel operations.

Loop limit
Indicates the start of a loop. Flip the shape vertically to indicate the end of a loop.

On-page Reference
Use this shape to create a cross-reference from one process to another on the same page of your flowchart.

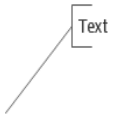
Off-page Reference shapes
Use this shapes to create a cross-reference and hyperlink from a process on one page to a process on another page.

Yes/No decision indicators



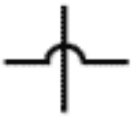
Condition

Control Transfer
A location in your diagram where control is transferred. The triangle can be positioned anywhere on the line.



Annotation
Adjustable text box with bracket you can use to add callouts or notes. Bracket height adjusts as text is typed.

- **Content of pipe Method B: designation by different lines**

ISO Designation	Symbol	Picture Representation
Flexible Line		Shows hose or other flexible line. Could be whole length or only a portion of the conduit.
Pipe Junction		Denotes a tee or cross where lines connect to one another. The connecting Dot is always used with the Jumper below. Preferred way.
Pipe Junction		Denotes pipes connecting at a tee or cross Optional way.
		Denotes pipes crossing. Preferred way
Pipes Crossing		Denotes pipes crossing. Optional way
Plug		
Air Bleed		Shows a connection for bleeding trapped air
Pressure Takeoff		A connection for taking power from a line or for pressure testing. Shown plugged.
		With takeoff line connected .
Energy Triangle		Pneumatic Hydraulic Shows direction of flow and type of fluid.
Power Source		Denotes a power source from another part of the schematic or a another source
Arrows		Indicates direction of rotation of a pump or motor shaft, valve actuator or other actuator.
		Indicates direction of movement of a component.
		Arrows used for flow direction in valves. Arrows with a perpendicular line opposite the arrow head Arrows with a perpendicular line at the head end indicates the path stays connected to its outlet when it moves
Sloping Arrow		A sloping arrow through a pump, valve, spring, cushion plunger, solenoid or other device indicates it is adjustable or variable.

- **Content of pipe Method C: designation by different colored lines according to the color code used in the industry**

ISO Designation	Symbol	Picture Representation
Basic Information Lines Continuous Non-Flowing Pump Flow Tank Flow Suction Flow Metered Flow Reduced Pressure Intensified Fluid	Black Red Blue Green Yellow Orange Purple	Represents a working fluid line. This fluid comes from a prime mover and goes to the actuator to perform work. May be a 1/8" plastic air line or any size pipe or tube in a hydraulic system. COLOR CODING FOR OVERHEADS
Long Dashes	Orange	Represents pilot lines that supply a small amount fluid to another valve or device making it operate. The length of these dashes should be at least ten times their thickness .
Short Dashes	Green	Represents drain lines for hydraulic circuits. Many hydraulic valves have internal leakage that can get trapped and cause a malfunction .A drain line is a small line giving trapped fluid a free flow path to tank. The length of these dashes is five times their thickness.
Double Lines		Represents a mechanical connection Between components, A pump motor shaft, feedback connections between valves and actuators, etc. The outside dimension of these lines should be at least five times the line hickness.
Center Line		Represents an enclosure outline that indicates the parts inside it are a unit. This unit may be a casting with the parts machined in it or it might be a several components assembly.
Electric Line		Denotes a line carrying electrical power or signal.

Manholes

Is a small covered opening in a paved area allowing access beneath, especially one leading to a sewer.

Fig show manhole

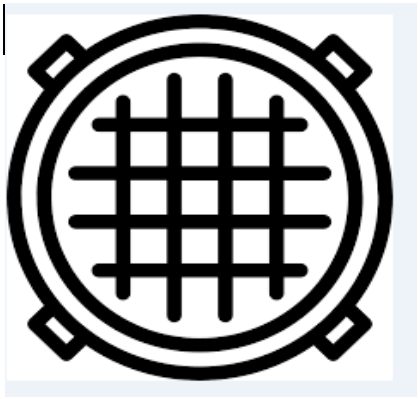


Fig manhole symbol

show

Storage cistern

A water tank is a container for storing water for use in the home over a number of different applications. It can supply any number of uses include drinking, washing, cooking, and the flushing of toilets.

Because the water is for domestic use, it's important that it is clean and free from impurities.

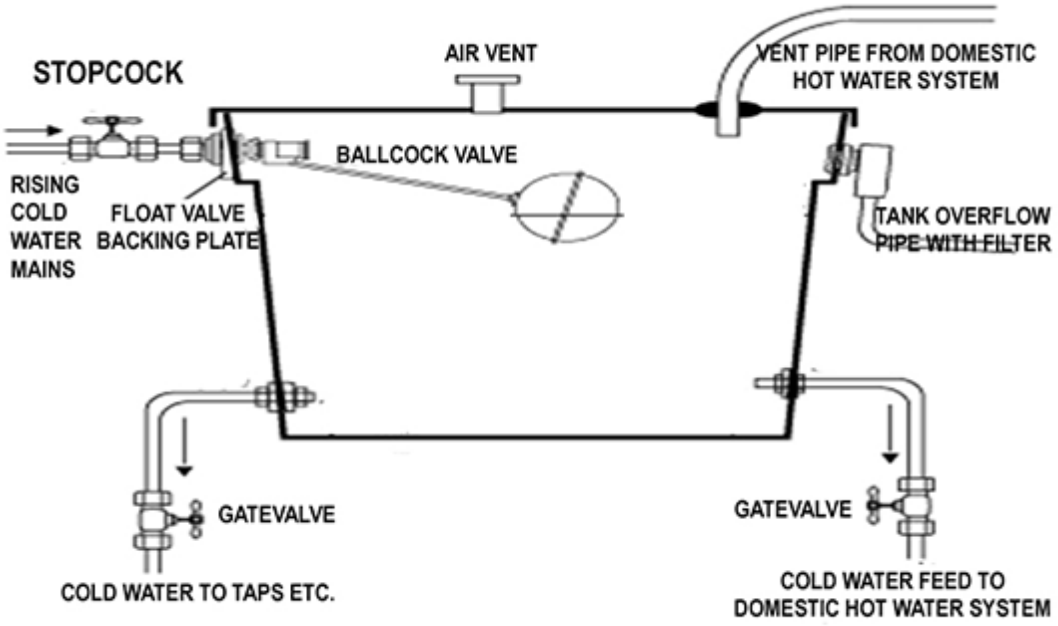


Fig showing Storage cistern

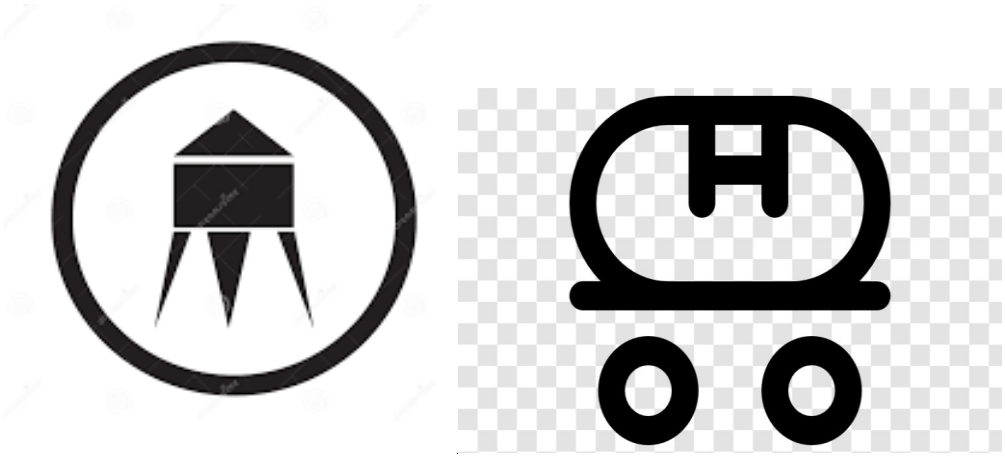


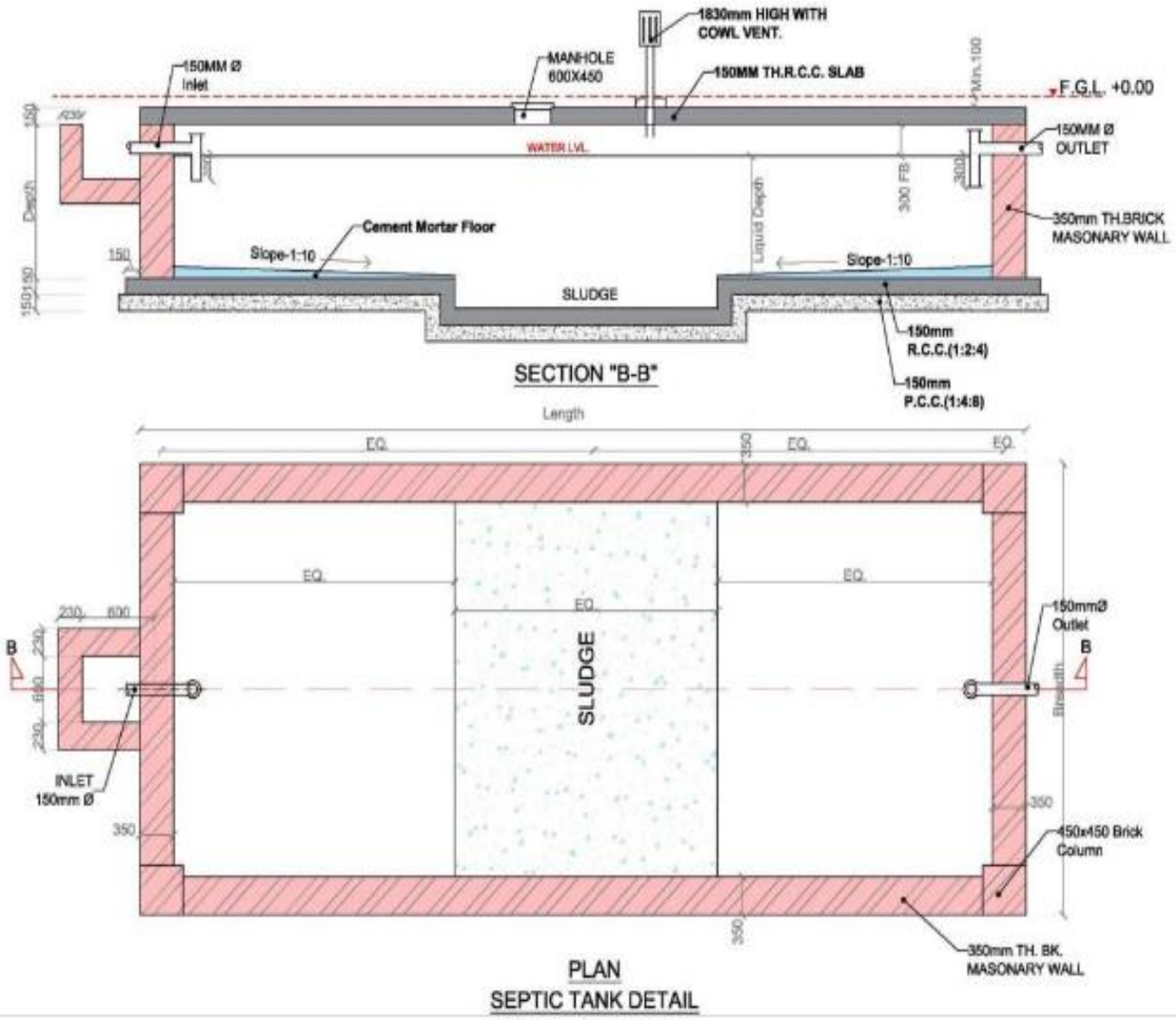
Fig show Sotrage cistern symbols

Septic tank

A septic tank is an underground chamber made of concrete, fiberglass, or plastic through which domestic wastewater flows for basic treatment. Settling and anaerobic processes reduce solids and organics, but the treatment efficiency is only moderate. Septic tank systems are a type of simple onsite sewage facility.

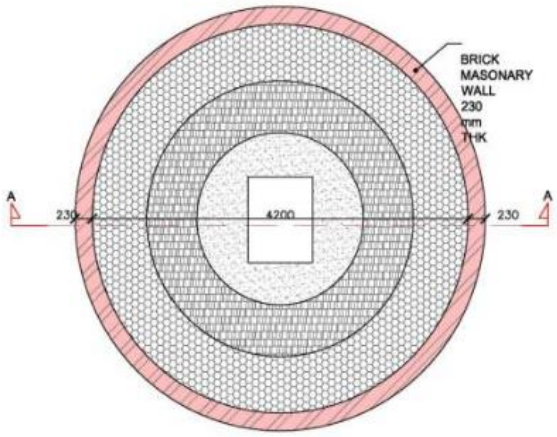
The construction of septic tanks is preferred in rural areas and the fringe area of suburban and also isolated buildings and institutions, hostels, hotels, small colonies where the underground sewage system with a complete treatment of sewage may neither be feasible nor economical or simply centralized sewerage systems does not exist.

The septic tank is primarily sedimentation basin where a minor degree of solids destruction may occur due to anaerobic digestion. Septic tanks are ordinarily sized to provide a 24- hour retention time at the average daily flow from various types of residential and public buildings.

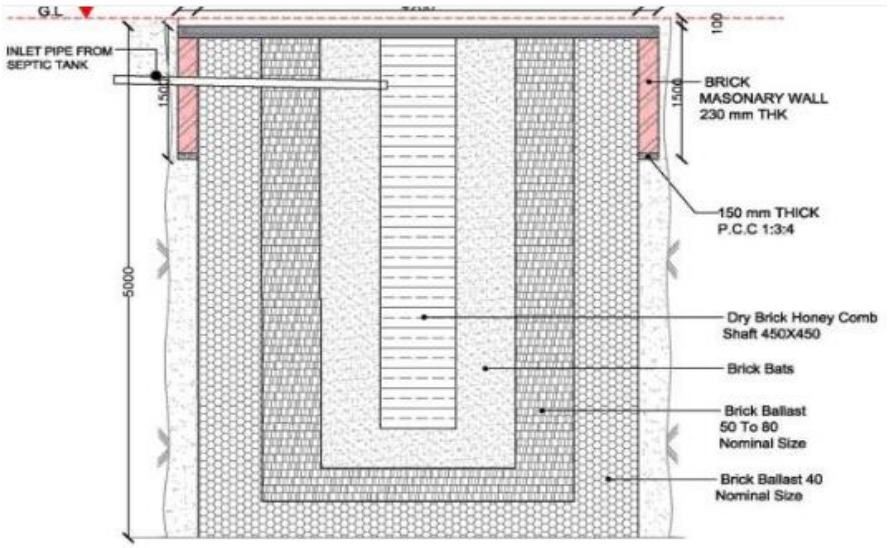


Soak Pit:

The soak pit is an ordinary pit of any shape with the least cross sectional dimension of 0.10m and 1m depth below invert level of the inlet pipe. The pit may be lined with stone, brick or concentrated blocks with dry open joints. The pit is generally filled with layer of loose stones, bricks bats and brick ballast. The pit may be covered with a RCC slab.



PLAN



SECTION"A-A"

The Soak pit is a pit through which effluent is allowed to seep or leach in to surrounding soil. The effluent may be disposed of in a soak pit. It should be minimum 18 m and preferably 30m away from any source of drinking water, such as well, even bore well to mitigate the possibility of bacterial pollution of water supply. It should also be away from the nearest habitable building by at least 6m, to avoid damage to the structure particularly foundations.

✔ **Pumping unit**

- **Pump**

A pump is a device that moves fluids, or sometimes slurries, by mechanical action, typically converted from electrical energy into Hydraulic energy. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.

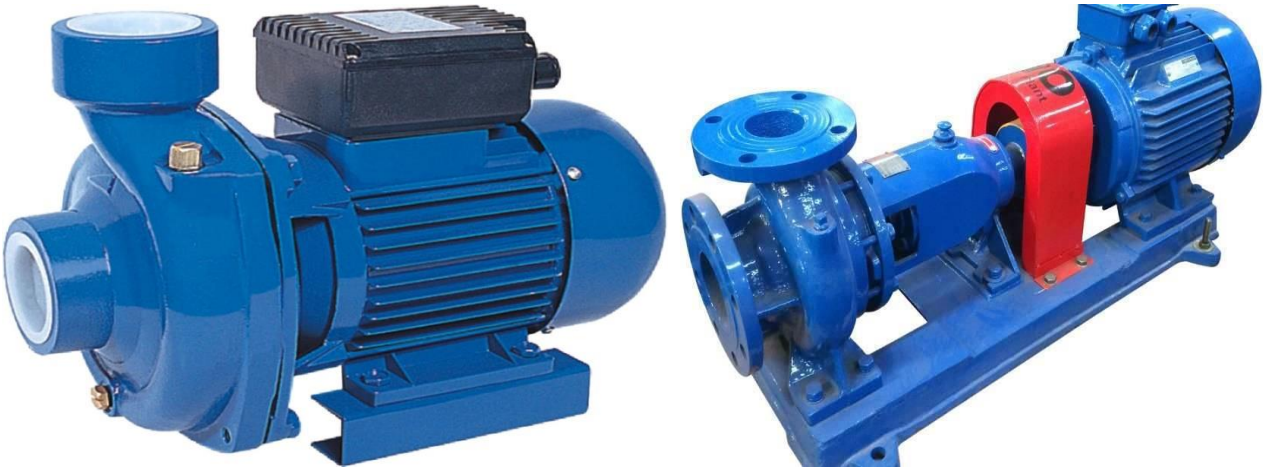


Fig show water pump

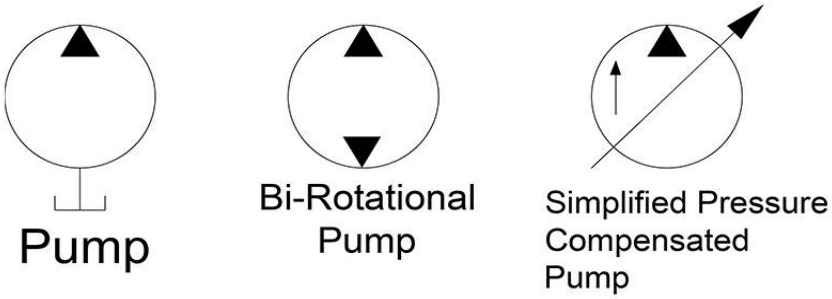
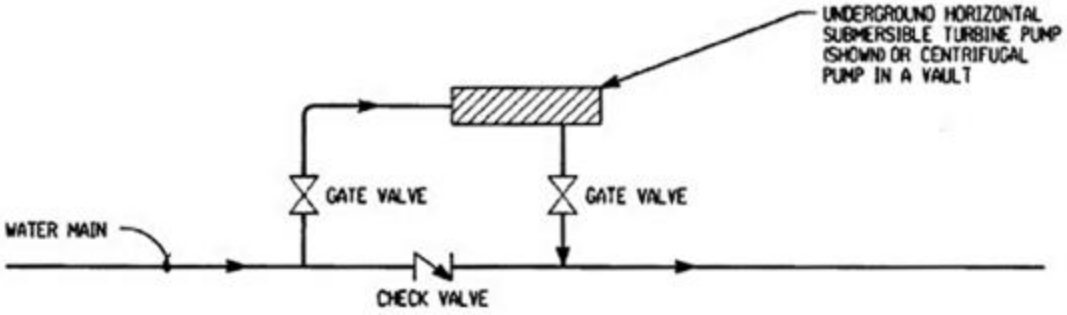


Fig show symbols of water tank

- **Booster pumps**.

Booster pump may be above-ground or underground. Pump and controls selection for inline booster pumps will consider minimum suction pressure, and automatic discharge cut-off pressure.

For small booster pump applications, as for remote housing or satellite military facilities with peak water demands of less than approximately 1500 gpm, the designer should consider a pre-assembled skid mounted package unit including all of its hydrostatic, flow, instrument and electrical components.



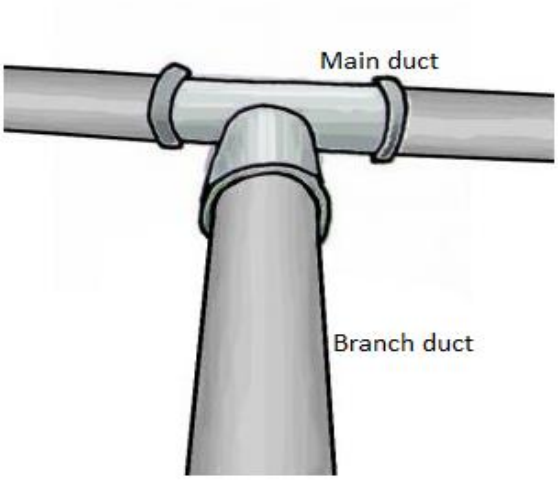
IN-LINE BOOSTER PUMP
(PLAN)

Learning Outcome 3.2: Design pipe laying and drainage system

Content /Topic 1 (Elements for installing drinking water distribution in a building)

✔ Main duct

Is any tube, canal, pipe, or conduit by which a fluid, air, or other substance is conducted or conveyed



✔ **An organ of stop (or just stop):**

Is a component of a pipe organ that admits pressurized air (known

as *wind*) to a set of organ pipes. Its name comes from the fact that stops can be used selectively by the organist; each can be "on" (admitting the passage of air to certain pipes), or "off" (*stopping* the passage of air to certain pipes).

The term can also refer to the control that operates this mechanism, commonly called a stop tab, stop knob, or draw knob. On electric or electronic organs that imitate a pipe organ, the same terms are often used, with the exception of the Hammond organ and clone wheel organs, which use the term "drawbar".

The term is also sometimes used as a synonym for register, referring to rank(s) of pipes controlled by a single stop.

Registration is the art of combining stops to produce a certain sound. The phrase "pull out all the stops" has entered general usage, for deploying all available means to pursue a goal.

✔ **Branch of pipe in building**

Branch means a soil-or-waste pipe connected at its upstream end to the junction of 2 or more soil-or-waste pipes or to a soil-or-waste stack, and connected at its downstream end to another branch, a sump, a soil-or-waste stack or a building drain

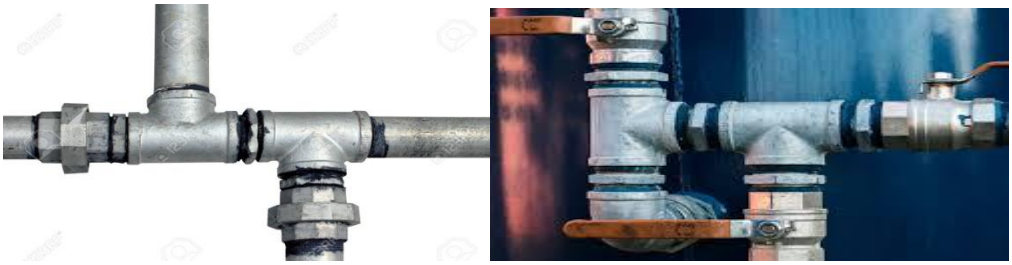


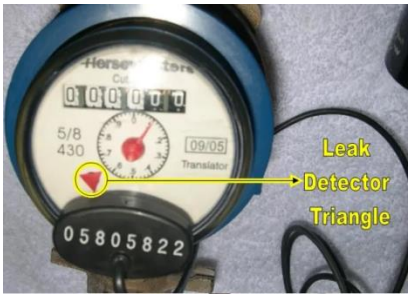
Fig show branch of pipe

✔ **Water meter:**

Water metering is the practice of measuring **water** use. **Water meters** measure the volume of **water** used by residential and commercial building units that

TYPES OF WATER MATER

There are four classes of meters measuring water in its different forms. These are **flow water meters,moisture meters, ice meters, and hygrometers (humidity in the air).** This article covers water meters - what they measure and how and where they are used.



What Water Meters Measure

Water meters measure the characteristics of liquid water: Its speed of flow, the quantity used, its pH balance, its quality, how well it conducts electricity. Many meters are used to calculate monthly water bills, others to measure just the right amount of liquid to add to a product or process.

How Meters are Read

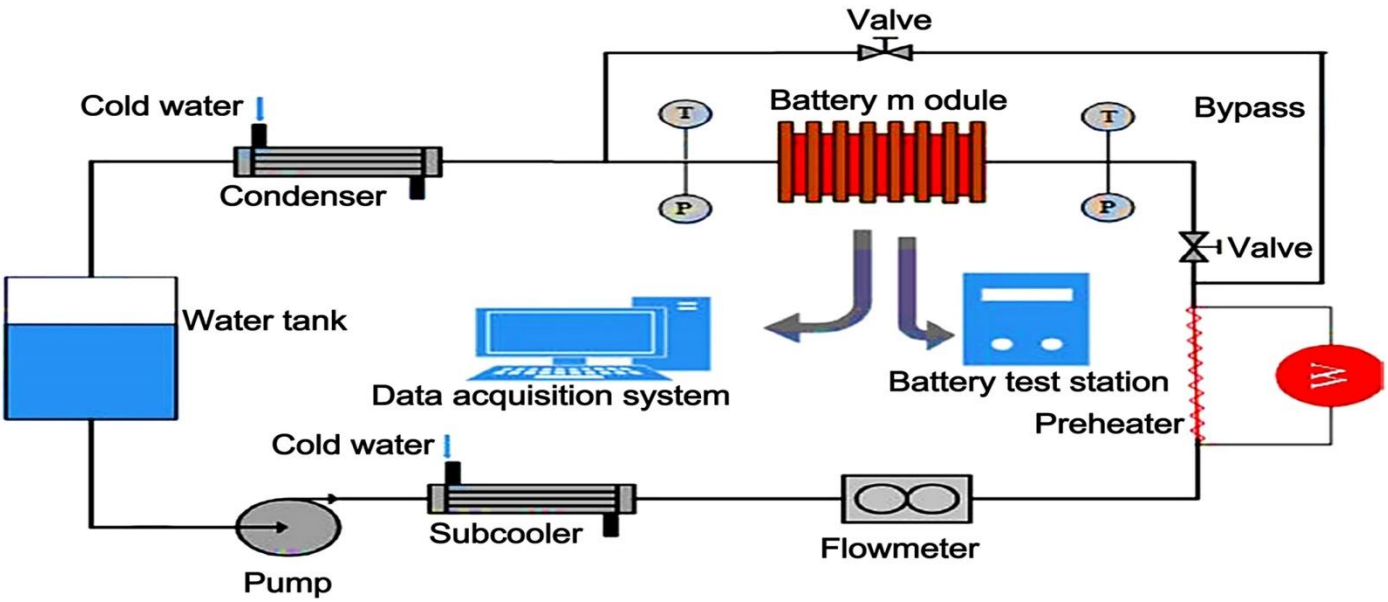
Meters are read in different ways, depending on the meter:
Via a clock-like face
One or several digital readings
Electronic communication with a local computer
Remotely from pulses sent from a meter to a reader driving by
Some are read by people, some by machines. The video below shows how a typical water flow meter is read. The information below it shows different types of water meters and what they do.

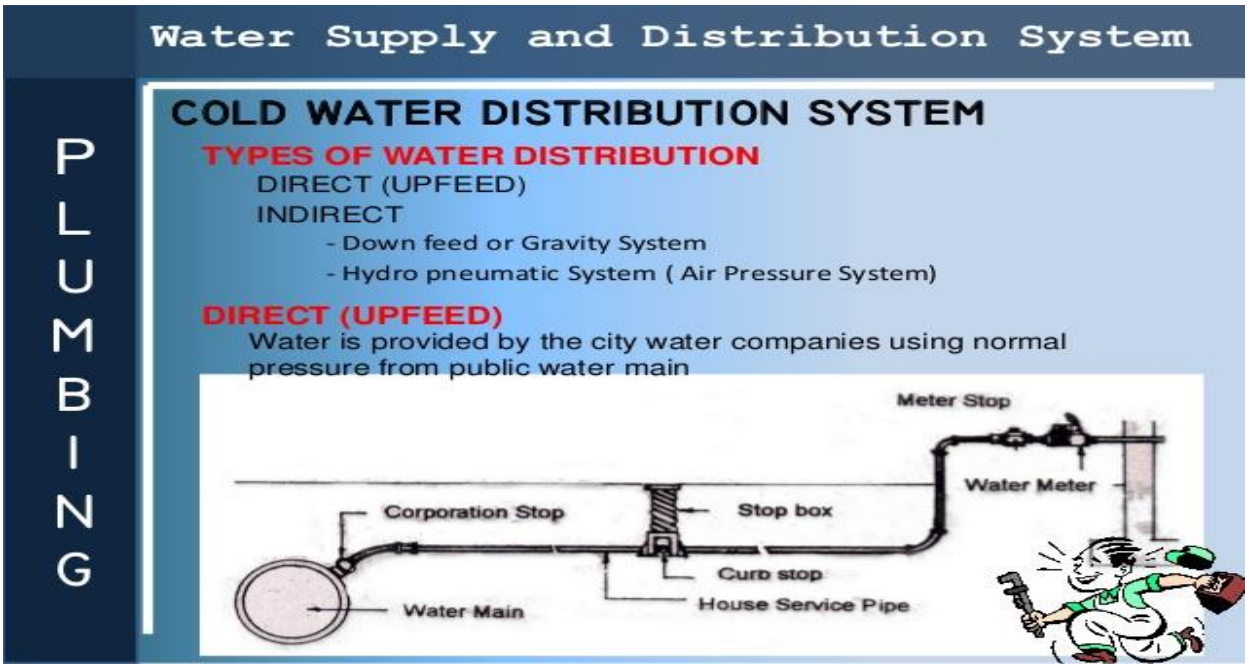
Water Flow Meter

This kind of meter is how water suppliers measure the amount of water their customers use during the month. The results added together help them monitor their water supply - making sure they have enough to supply everyone - and also tells them how much usage to bill you for each month

- ✔ **Battery of distribution of cold water**

A mixing device for hot and cold water comprises hot and cold water distributors. Each distributor includes a valve, a membrane supporting the valve, a seat whereon the membrane supports the valve, the valve seat being arranged between an upstream and a downstream chamber, and the membrane delimiting a counter-pressure chamber. A nozzle is mounted for movement with the valve, and an axially movable tapering central rod passes through the nozzle and defines therewith a variable passage in communication with the upstream chamber and with a feed opening in the membrane for interconnecting the upstream and counter-pressure chambers. A compensating piston is mounted in the upstream chamber and biases the rod for axial movement under the pressure prevailing in the upstream chamber.





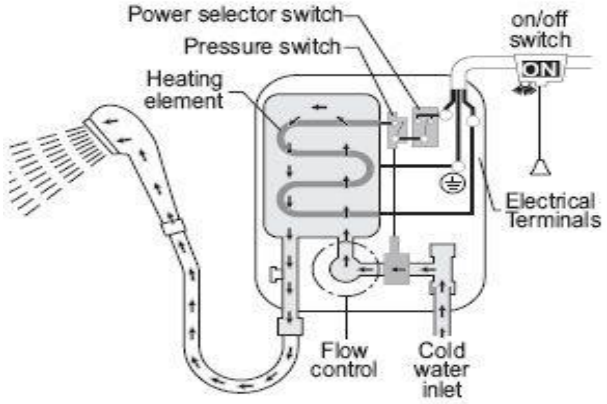
✔ Horizontal distribution pipe

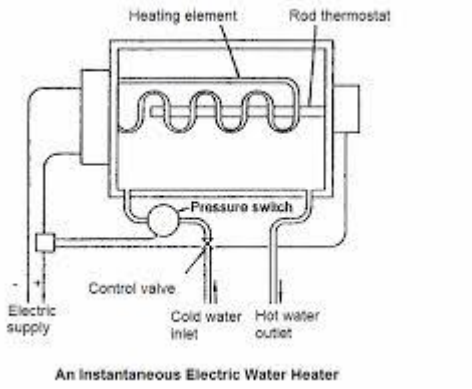
A one-pipe system where the water is piped horizontally is to be preferred in situations where it is undesirable to have a vertical pipe up through the rooms.
Such a system is more difficult to vent, so all radiators need to have an air vent screw


fig show horizontal distribution of water

✔ **Risers and hot water circuit**

In the riser zone water is supplied from basement distribution of the basement floor distribution. Limited space and limited access are dominant challenges. Well-insulated cable strands save energy and keep the water fresh.





An Instantaneous Electric Water Heater

✔ **Derivation of floor**

A floor drain is a plumbing fixture that is installed in the floor of a structure, mainly designed to remove any standing water near it. They are usually round, but can also be square or rectangular. They usually range from 2 to 12 inches (5.1 to 30.5 cm); most are 4 inches (10 cm) in diameter.

They have gratings that are made of metal or plastic. The floor around the drain is also sloped to allow the water to flow to the drain.

Many residential basements have one or more floor drains, usually near a water heater or washer/dryer. Floor drains can also be found in commercial basements, restrooms, kitchens, refrigerator areas, locker/shower rooms, laundry facilities, and near swimming pools, among other places.

A floor drain should always have a strainer secured over it to prevent injury, entry of foreign objects, or introduction of unwanted pests into the facility. However, if the strainer is not smooth enough, hair and other objects can still get stuck in it, clogging the drain.


Fig show derivation floor

✔ **Connecting devices**

The management of a precious asset such as drinking water requires, in addition to safety and efficient lines of distribution, also specific devices that optimize its consumption and protect both the domesticsystem and the public supply network. Pressure reducing valves, pollution preventors, thermostatic mixers are some of the products that can enhance modern plumbing and drainage systems.


Fig show connecting devices

✔ **Stand pipe**

is a type of rigid water piping which is built into multi-story buildings in a vertical position or bridges in a horizontal position, to which fire hoses can be connected, allowing manual application of water to the fire. Within the context of a building or bridge, a standpipe serves the same purpose as a fire hydrant.



Fig show stand pipe

Content /Topic 2 (Connecting to building)

✔ Recovery

A water heater's "**recovery** time" (also called "**recovery** rate") is the amount of hot water (in gallons) a tank water heater can provide in just one hour after being completely drained. **Recovery** rate basically gives you an idea of how fast a water heater can heat water.

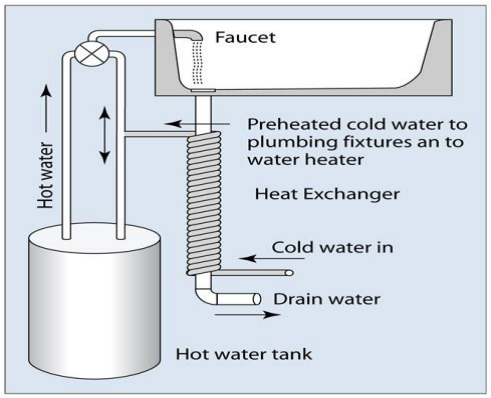
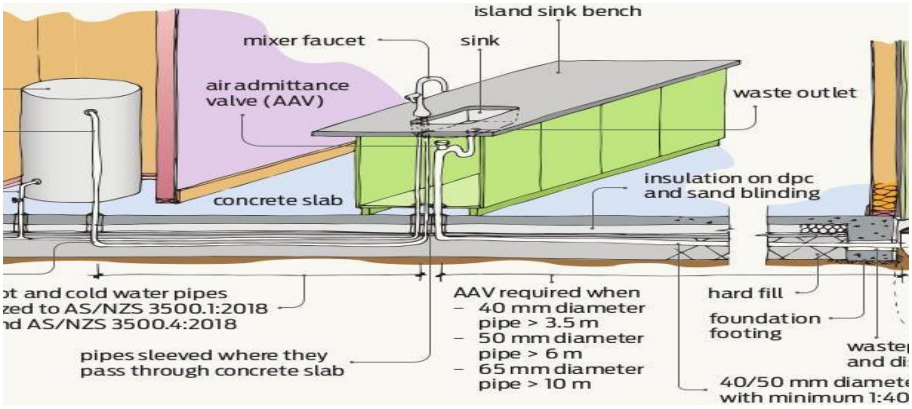


fig show drain heat water recovery

✔ Concrete bench

Benching as it relates to trenchless operations is defined as the smoothed infill concrete placed between the channel pipes and the chamber walls of a manhole. Benching influences the hydraulic flow through the manhole during sanitary sewer and drainage events. The shape and elevation of the benching prevent rodents from leaving the system and avoid the buildup of waste in the manhole that results in blockages.

The finished surface of the benching is smooth so that it is self-cleaning and allows for the unimpeded flow of sewage or drainage. Benching is typically formed from the channel's edge, at the minimum, the pipe's crown to allow for smooth flow. There should be no gaps, as water should not be allowed to penetrate through the benching.



- ✔ Distance to road-wolf
- ✔ **Building entrance**

Gas piping entering the building must be protected from accidental damage by vehicles, foundation settlement or vibration. Where practical, the entrance should be above grade and provided with a self-tightening swing joint prior to entering the building. Gas piping shall not be placed in unventilated spaces, such as trenches or unventilated shafts, where leaking gas could accumulate and explode.

- ✔ **Crossing the wall**

The pipes that power faucets, showers, toilets, and other fixtures are typically hidden behind walls or underneath floors, a setup that requires careful planning to install properly. Once you've drawn a plan for new plumbing service, it's important that you also develop a strategy for running the pipes. In a new building or addition where the framing is exposed, this is easy. If you are remodeling a bathroom or kitchen, be prepared to make changes in the plan once you've removed the wall covering and flooring.

Replacing finished surfaces after plumbing (especially patching walls) usually takes several days. Repairing a large wall patch (or even replacing an entire wall) takes only a little more time than a small patch, so open plenty of space for working.

Once you've opened the vent and drain lines, running the supplies, which usually run alongside drain-waste-vent (DWV) lines, will be relatively easy. Before you begin, brush up on basic carpentry skills, understand your home's structure, and make sure you know how to install pipe. It's also a good idea to get your plan approved by the local building department to make sure it adheres to plumbing codes.

Replacing finished surfaces after plumbing (especially patching walls) usually takes several days. Repairing a large wall patch (or even replacing an entire wall) takes

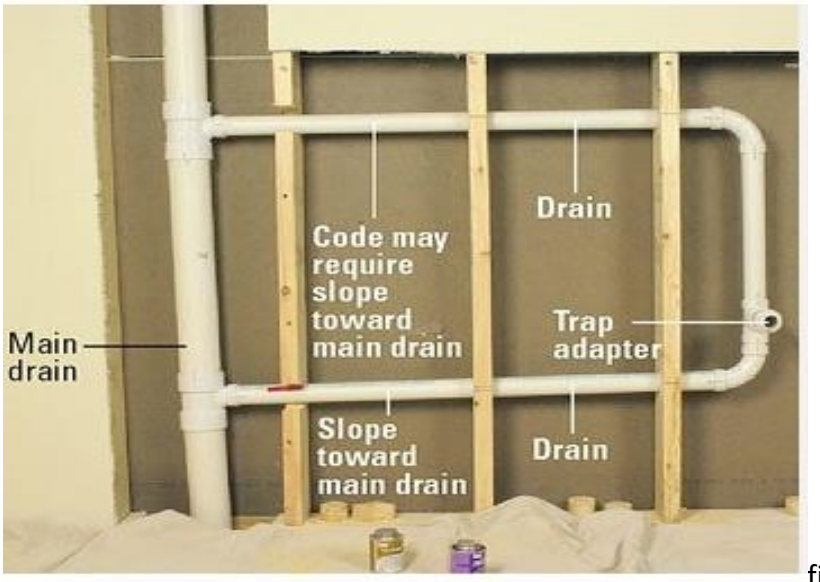


fig show pipe cross the wall

- **Content /Topic 3 (Position and measure battery distribution)**
  - ✔ Variant a
  - ✔ Variant b
  - ✔ Variant c
  - ✔ Mounting dimension
- **Content /Topic 3 (Connecting thin filters)**

Drain the System

First, turn off the water supply at the main water-supply shutoff. Next, from the lowest point in the home, open a faucet to release pressure and drain most of the water from the system.

Fig show drainage of system before installing filter

Cut the Pipe

Once you've selected the location for your filter, use the template provided with the kit to mark the pipe for exact placement. Remember that you'll need to change the cartridge periodically, and select a location with enough clearance beneath the filter tank to allow easy removal and reattachment.

Use a pipe cutter to make two cuts, and remove the marked section of pipe. Use the twist handle to tighten the cutter onto the pipe so the blade lines up with your mark, then rotate the cutter around the pipe as you continue twisting the handle. Keep rotating the cutter around the pipe until it cuts all the way through. This may take a minute or so. (Have a bucket handy to catch any excess water when the pipe is cut -- especially if you're standing directly underneath.) Once you've cut out the section, use the reamer blade on the cutter to remove any burrs from inside the freshly cut pipe.

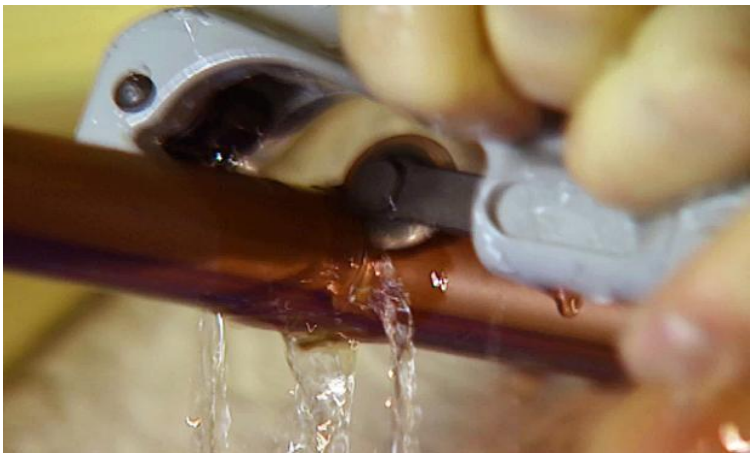


fig show cutted pipe by using pipe cuter

Attach the Fittings

Place a compression nut, small end first, on one of the cut pipe ends. Slide on the ferrule (Image 1). Repeat the same steps on the other side.

Thread a brass fitting onto the "in" and the "out" ports of the filter housing. Install them according to the manufacturer's recommendations. (In this example, the red seal inserts into the port.) (Image 2) Use Teflon tape to ensure a good seal between the fitting and the filter port. Tighten the fittings onto the filter until they're snug, but don't over-tighten.

 fig show attachment of filter

Position the Filter

Important: Install the filter so the flow of water enters the "in" port and exits through the "out" port. The filter won't function properly if installed backward. (The "in" port should be on the end closer to the water meter; the "out" should point toward the water heater.)

Position the filter on the water line, and let it hang temporarily between the two ferrules (Image 1).

Hand tighten the compression nuts onto the fitting bodies. Keeping the filter straight and upright, tighten the fittings, using two wrench.

Fig show position of the filter

Turn On the Water

The filter kit comes with a special handle used to turn the inlet valve on top to various positions -- "off," "bypass" and "filter." With the filter properly installed, turn the valve to the "off" position. Slowly turn the water back on at the main shutoff valve, and check the filter for leaks.

Use the handle to turn the valve from "off" to the "filter" position. The tank should fill with water and the unit will begin filtering. Check again for leaks. If you detect leaks at the compression fittings or the filter housing, tighten until the dripping stops.

Change the Filter as Needed

You'll need to change the cartridge at intervals recommended by the manufacturer. In the case of the whole-house filter, the handle used to turn the inlet valve doubles as a tool to remove the filter tank when it's time to change filters.

Turn the valve handle to the "off" position.

Use the handle to loosen and remove the tank from the housing. Have a bucket handy to catch any water.

Pour the water from the tank and discard the old cartridge. Wipe the inside of the tank with a clean cloth.

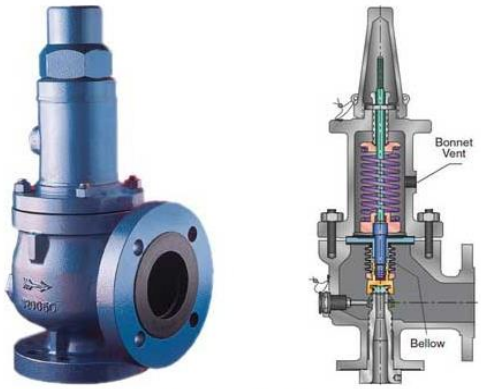
Insert a new cartridge and reattach the tank to the housing. Return the valve to the "filter" position.
Open one of the faucets slowly, and allow the water to run for a few seconds to allow trapped air to escape.

- **Content /Topic 4 (Installation overpressure)**

A pressure Relief Valve is a safety device designed to protect a pressurized vessel or system during an overpressure event.
An overpressure event refers to any condition which would cause pressure in a vessel or system to increase beyond the specified design pressure or maximum allowable working pressure

The primary purpose of a pressure Relief Valve is protection of life and property by venting fluid from an over pressurized vessel.

Many electronic, pneumatic and hydraulic systems exist today to control fluid system variables, such as pressure, temperature and flow. Each of these systems requires a power source of some type, such as electricity or compressed air in order to operate. A pressure Relief Valve must be capable of operating at all times, especially during a period of power failure when system controls are nonfunctional. The sole source of power for the pressure Relief Valve, therefore, is the process fluid.



Pressure Relief Valve Bellow Type

- **Content /Topic 5 (Protection against water returns)**

The utility model provides a floating-type return prevention valve for a squatting pan, which is adhered to the opening of a sewage conduit below the squatting pan; a valve body has a cylindrical structure; a sewage outlet is arranged at the bottom of the cylindrical structure; a lifting lug is arranged at the upper part of the valve body; and a shaft of the floating-type valve is hinged with the lifting lug.

Under a normal condition, the floating-type valve is vertically hung below the lifting lug; once the main pipeline of the sewage conduit is blocked, the water level of the sewage conduit is caused to rise, the floating-type valve turns upward due to buoyancy of water and is fastened tightly on the sewage outlet of the valve body, and the greater the water pressure is, the tighter the fastening is.

Therefore, sewage is prevented from passing through the squatting pan to return to the interior, the coordinated use of the floating-type return prevention valve for the squatting pan and a rocker valve type return prevention floor drain makes perfect, interferences from the smell of the drain and the sewage are avoided, and the real purpose of interior environmental protection is achieved.

Fig show Backflow prevention containment devices stop

- **Content /Topic 6(Connecting the water heater)**

Here we describe the plumbing connections and piping options for hot water system hook-ups. We explain the piping for a basic water heater installation compared with options for connecting hot water heaters in parallel, in series, or ganged.

Included a typical time estimates to install a water heater. Plumbing war story: geyser wars: what can go wrong when installing a part on a water cylinder (water heater). We describe a water heater relief valve repair catastrophe when just touching parts leads to a flooded basemen.

Installing the New Water Heater

The following steps will explain how to install an electric water heater.

Caution

Water heaters are heavy so use a helper, appliance dolly or hand truck when moving the appliance.

Step 1: Set the New Heater in Place

Place the new water heater in a drain pan. You can avoid possible flooding by routing a pipe from the drain pan to a drain.

Step 2: Install the T&P Valve
Step 3: Install the Discharge Pipe
Step 4: Hook Up the Water
Step 5: Install the Fittings
Step 6: Secure the Fitting
Step 7: Secure the Compression Nut
Step 8: Install Seismic Straps
Step 9: Fill the Tank
Step 10: Flush the Tank
Step 11: Connect the Wiring
Step 12: Turn the Power On
Step 13: Set the Water Temperature
Step 14: Check the Discharge Pipe
Step 15: Check Aeration

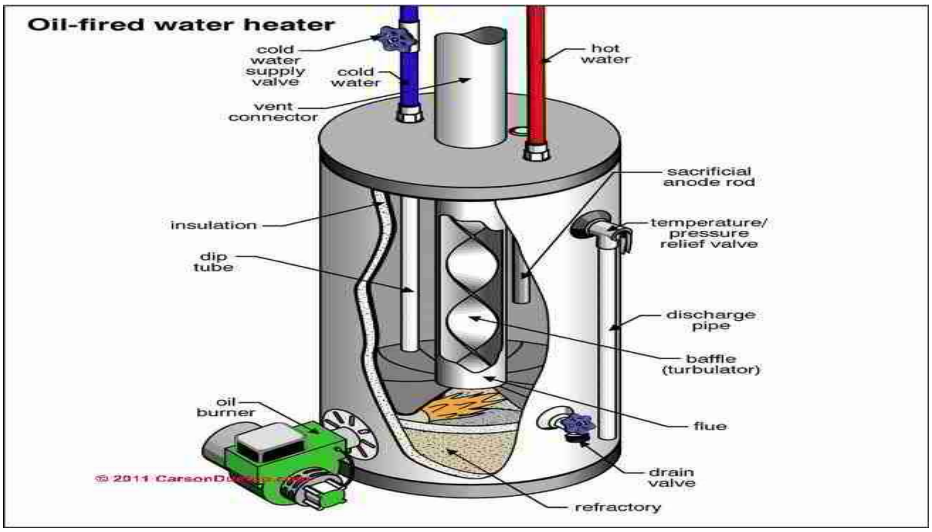


Fig show water heater

- Content /Topic7(Distribution modes)

  - ✔ With distribution battery
  - ✔ With stretched distribution

Learning Outcome 3.3: Use CAD

- **CAD (Computer Aided Design) latest version**

Computer-aided design (CAD) is the use of computers (or workstations) to aid in the creation, modification, analysis, or optimization of a design.

CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing.

CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used.

Its use in designing electronic systems is known as electronic design automation (EDA). In mechanical design it is known as mechanical design automation (MDA) or computer-aided drafting (CAD), which includes the process of creating a technical drawing with the use of computer software.

CAD software for mechanical design uses either vector-based graphics to depict the objects of traditional drafting, or may also produce raster graphics showing the overall appearance of designed objects. However, it involves more than just shapes. As in the manual drafting of technical and engineering drawings, the output of CAD must convey information, such as materials, processes, dimensions, and tolerances, according to application-specific conventions.

CAD may be used to design curves and figures in two-dimensional (2D) space; or curves, surfaces, and solids in three-dimensional (3D) space.

CAD is an important industrial art extensively used in many applications, including automotive, shipbuilding, and aerospace industries, industrial and architectural design, prosthetics, and many more. CAD is also widely used to produce computer animation for special effects in movies, advertising and technical manuals, often called DCC digital content creation. The modern ubiquity and power of computers means that even perfume bottles and shampoo dispensers are designed using techniques unheard of by engineers of the 1960s. Because of its enormous economic importance, CAD has been a major driving force for research in computational geometry, computer graphics (both hardware and software), and discrete differential geometry.

The design of geometric models for object shapes, in particular, is occasionally called computer-aided geometric design (CAGD).

Uses of CAD

Computer-aided design is one of the many tools used by engineers and designers and is used in many ways depending on the profession of the user and the type of software in question.

CAD is one part of the whole digital product development (DPD) activity within the product lifecycle management (PLM) processes, and as such is used together with other tools, which are either integrated modules or stand-alone products, such as:

- Computer-aided engineering (CAE) and finite element analysis (FEA, FEM)
- Computer-aided manufacturing (CAM) including instructions to computer numerical control (CNC) machines

- Photorealistic rendering and motion simulation.
- Document management and revision control using product data management (PDM)

CAD is also used for the accurate creation of photo simulations that are often required in the preparation of environmental impact reports, in which computer-aided designs of intended buildings are superimposed into photographs of existing environments to represent what that locale will be like, where the proposed facilities are allowed to be built.

STARTING ArchiCAD

Select the ArchiCAD icon from the desktop

ArchiCAD

THE ArchiCAD SCREEN

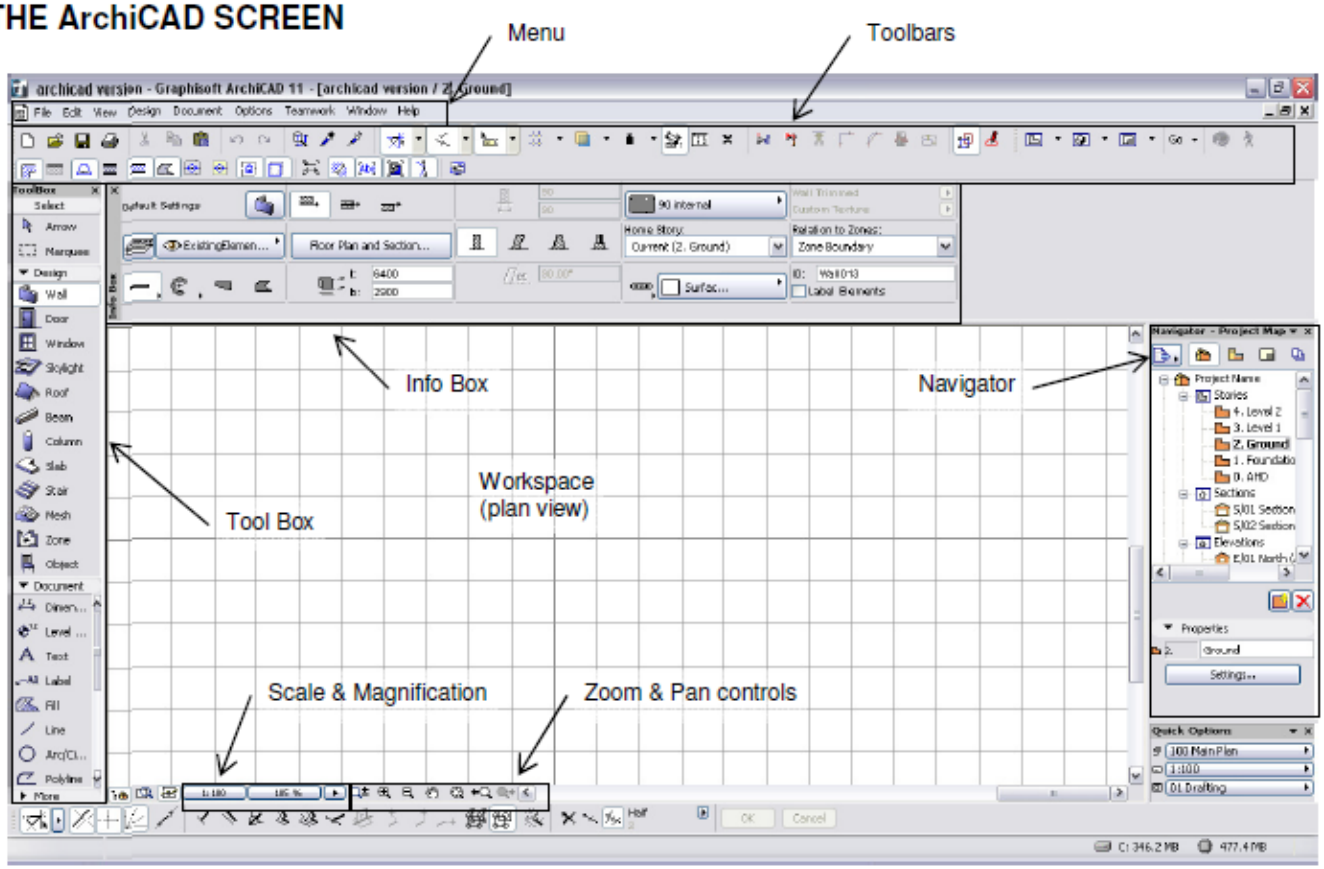


Fig show the archicad screen

Elements Of CAD Design Services

1) **Computer Aided Analysis**. The main limitation of human intervention in certain task is, monotonous activities leading to errors and certain tough tasks leading to inaccuracy. ...
2) **Computer Aided Visualization.** Visualization is the key element to any design. ...
3) **Computer Aided Synthesis.**

The advantages of **CAD** include:

1) Increase productivity
2) Reuse and easily change designs
3) Easier to read
4) Simplified sharing
5) Documenting the design
6) Decrease in error percentage
7) Decrease in effort
8) Saves times
9) Easy to edit

Drawings can be created in 2D or 3D and rotated; other computer programs can be linked to the design software. With manual drafting, you must determine the scale of a view before you start drawing.

Disadvantages of CAD:

1) Work can be lost because of the sudden breakdown of computers.
2) Work is prone to viruses.
3) Work could be easily "hacked"
4) Time taking process to know how to operate or run the software.
5) High production or purchasing cost for new systems.
6) Time and cost of training the staff which will work on it.

Learning Outcome 3.4: Prepare Bills of Quantities (BQs) of plumbing work

- Content/Topic 1 (Example of determination of the diameters of the pipes)

Typical installation for a family home

Even these velocities can be high in terms of their effect on pressure drop. In longer supply lines, it is often necessary to restrict velocities to 15 m/s to avoid high pressure drops. It is recommended that pipelines over 50 m long are always checked for pressure drop, no matter what the velocity.

By using Table 10.2.4 as a guide, it is possible to select pipe sizes from known data; steam pressure, velocity and flow rate.

Table 10.2.4
Saturated steam pipeline capacities in kg/h for different velocities (Schedule 40 pipe)

Pressure bar g	Velocity m/s	Pipe size (nominal)										
		15	20	25	32	40	50	65	80	100	125	150
		Actual inside pipe diameter Schedule 40										
		15.80	20.93	26.64	35.04	40.90	52.50	62.70	77.92	102.26	128.20	154.05
		Pipeline capacity kg/h										
0.4	15	9	15	25	43	58	95	136	210	362	569	822
	25	14	25	41	71	97	159	227	350	603	948	1 369
	40	23	40	66	113	154	254	363	561	965	1 517	2 191
0.7	15	10	18	29	51	69	114	163	251	433	681	983
	25	17	30	49	85	115	190	271	419	722	1 135	1 638
	40	28	48	78	136	185	304	434	671	1 155	1 815	2 621
1	15	12	21	34	59	81	133	189	292	503	791	1 142
	25	20	35	57	99	134	221	315	487	839	1 319	1 904
	40	32	56	91	158	215	354	505	779	1342	2 110	3 046
2	15	18	31	50	86	118	194	277	427	735	1 156	1 669
	25	29	51	83	144	196	323	461	712	1 226	1 927	2 782
	40	47	82	133	230	314	517	737	1 139	1 961	3 083	4 451
3	15	23	40	65	113	154	254	362	559	962	1 512	2 183
	25	38	67	109	188	256	423	603	931	1 603	2 520	3 639
	40	61	107	174	301	410	676	964	1 490	2 565	4 032	5 822
4	15	28	50	80	139	190	313	446	689	1 186	1 864	2 691
	25	47	83	134	232	316	521	743	1 148	1 976	3 106	4 485
	40	75	132	215	371	506	833	1 189	1 836	3 162	4 970	7 176
5	15	34	59	96	165	225	371	529	817	1 408	2 213	3 195
	25	56	98	159	276	375	619	882	1 362	2 347	3 688	5 325
	40	90	157	255	441	601	990	1 411	2 180	3 755	5 901	8 521
6	15	39	68	111	191	261	430	613	947	1 631	2 563	3 700
	25	65	114	184	319	435	716	1 022	1 578	2 718	4 271	6 167
	40	104	182	295	511	696	1 146	1 635	2 525	4 348	6 834	9 867
7	15	44	77	125	217	296	487	695	1 073	1 848	2 904	4 194
	25	74	129	209	362	493	812	1 158	1 788	3 080	4 841	6 989
	40	118	206	334	579	788	1 299	1 853	2 861	4 928	7 745	11 183
8	15	49	86	140	242	330	544	775	1 198	2 063	3 242	4 681
	25	82	144	233	404	550	906	1 292	1 996	3 438	5 403	7 802
	40	131	230	373	646	880	1 450	2 068	3 194	5 501	8 645	12 484
10	15	60	105	170	294	401	660	942	1 455	2 506	3 938	5 686
	25	100	175	283	490	668	1 101	1 570	2 425	4 176	6 563	9 477
	40	160	280	453	785	1 069	1 761	2 512	3 880	6 682	10 502	15 164
14	15	80	141	228	394	537	886	1 263	1 951	3 360	5 281	7 625
	25	134	235	380	657	896	1 476	2 105	3 251	5 600	8 801	12 708
	40	214	375	608	1 052	1 433	2 362	3 368	5 202	8 960	14 082	20 333

Alternatively the pipe size can be calculated arithmetically. The following information is required, and the procedure used for the calculation is outlined below.

Information required to calculate the required pipe size:

Example

Example

A process requires 5 000 kg/h of dry saturated steam at 7 bar g. For the flow velocity not to exceed 25 m/s, determine the pipe size.

Where:

Flow velocity (u) = 25 m/s

Specific volume at 7 bar g (v_g) = 0.24 m^3/kg

Mass flowrate ($\dot{m}$) = 5 000 kg/h or 1.389 kg/s

Volumetric flowrate = $\dot{m} \times v_g$

Volumetric flowrate = 1.389 kg/s x 0.24 m^3/kg

Volumetric flowrate = 0.333 m^3/s

Therefore, using:

$$\text{Cross sectional area (A)} = \frac{\text{Volumetric flowrate } (\dot{V})}{\text{Flow velocity (u)}}$$

$$\frac{\pi \times D^2}{4} = \frac{\dot{V}}{u}$$

$$D^2 = \frac{4 \times \dot{V}}{\pi \times u}$$

$$D = \sqrt{\frac{4 \times \dot{V}}{\pi \times u}}$$

$$\text{Pipe diameter (D)} = \sqrt{\frac{4 \times 0.333}{\pi \times 25}}$$

Pipe diameter (D) = 0.130 m or 130 mm

Since the steam velocity must not exceed 25 m/s, the pipe size must be at least 130 mm; the nearest commercially available size, 150 mm, would be selected.

✔ Typical installation for a family home

A single-family home is an independent residential structure that sits on its own land and is designed to be used as a single dwelling unit, having just one kitchen, unshared walls and unshared utilities

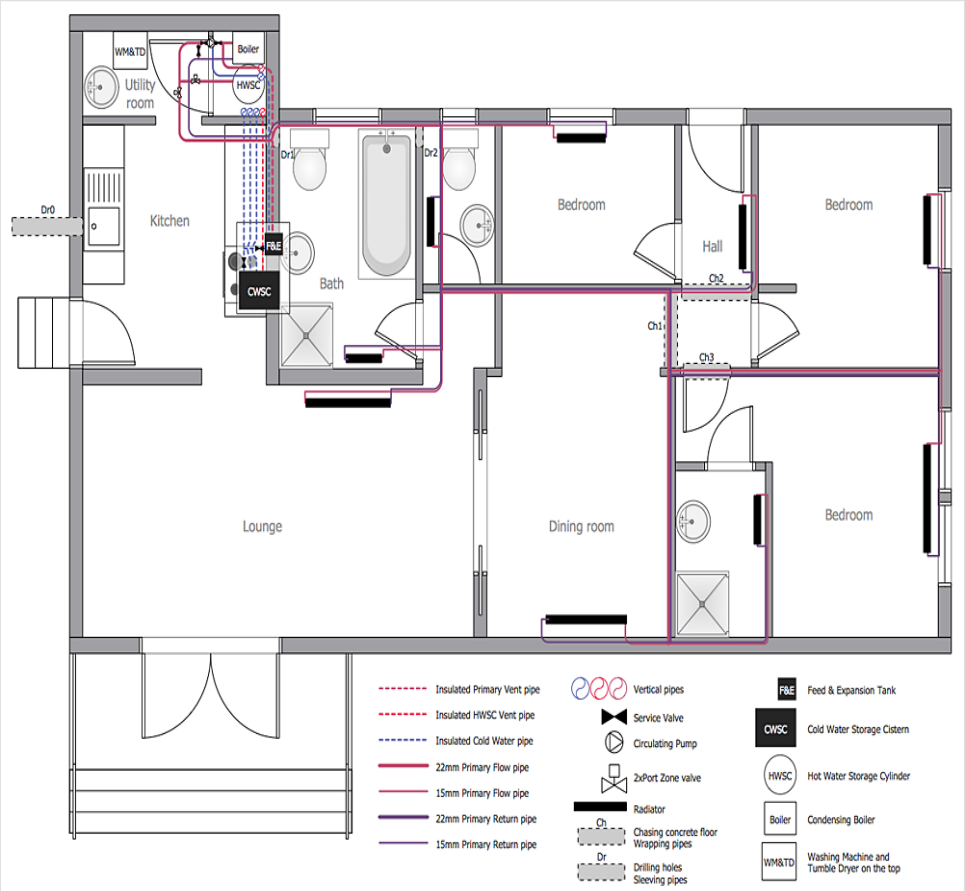


Fig showing sanitary appliances installation in residential family home

- **Content/Topic 2(Example of determination of an estimate cost for plumbing system)**

S.L	Description of Items	Qty.	Rate/unit	Total Amount
1.0	**PIPE ACCESSORIES:**			
	Supply of pipe accessories such gate valve, globe valve; check valve, strainer, expansion joint etc. Pipe accessories shall be suitable to withstand a pressure of 10kg/sq. cm. Valve of 65 mm dia and above shall be of flanged end type complete with companion flanges, gasket, nut bolts etc and valve less than 65 mm dia shall be bronze body threaded end type.			
1.01	**GATE VALVES:**			
	Butter fly valve shall be lever-operated type, anti corrosive cast iron body Valve up to 80 mm dia shall be welded socket ball type complete with companion flanges, nut-bolt, gasket etc.			
	a) 250 mm dia	N/A		
	b) 200 mm dia	2		
	c) 150 mm dia	12		
	d)125 mm dia	N/A		
	e) 100 mm dia	N/A		
	f) 40 mm dia (ball)	23		
	g) 25 mm dia (ball)	17		
	h) 20 mm dia (ball)	6		
	i) 15 mm dia (ball)	5		
1.02	**Globe Valve:**			
	Globe Valve shall be lever- operated type, ani corrosive cast iron body. Valve up to 80mm dia shall be welded socket ball type complete with companion flange, nut-bolt, gasket etc.			
	a) 250 mm dia	N/A		
	b) 200 mm dia	2		
	c) 150 mm dia	12		
	d)125 mm dia	N/A		

✔ Typical installation for a rental building

Residential rental property refers to homes that are purchased by an investor and inhabited by tenants on a lease or other type of rental agreement. Residential property is property zoned specifically for living or dwelling for individuals or households; it may include standalone single-family dwellings to large, multi-unit apartment buildings.

Residential rental property may be contrasted with commercial rental property, which is instead leased out to businesses in properties zoned explicitly for profit generation.

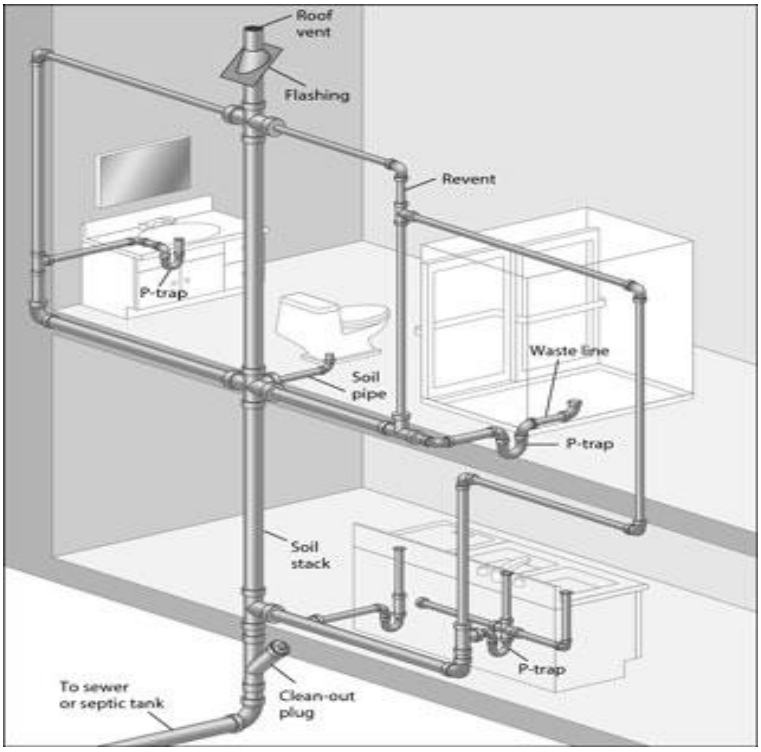


Fig show installation of water in rental building

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