PIPING DRAFTING

3D-LABS

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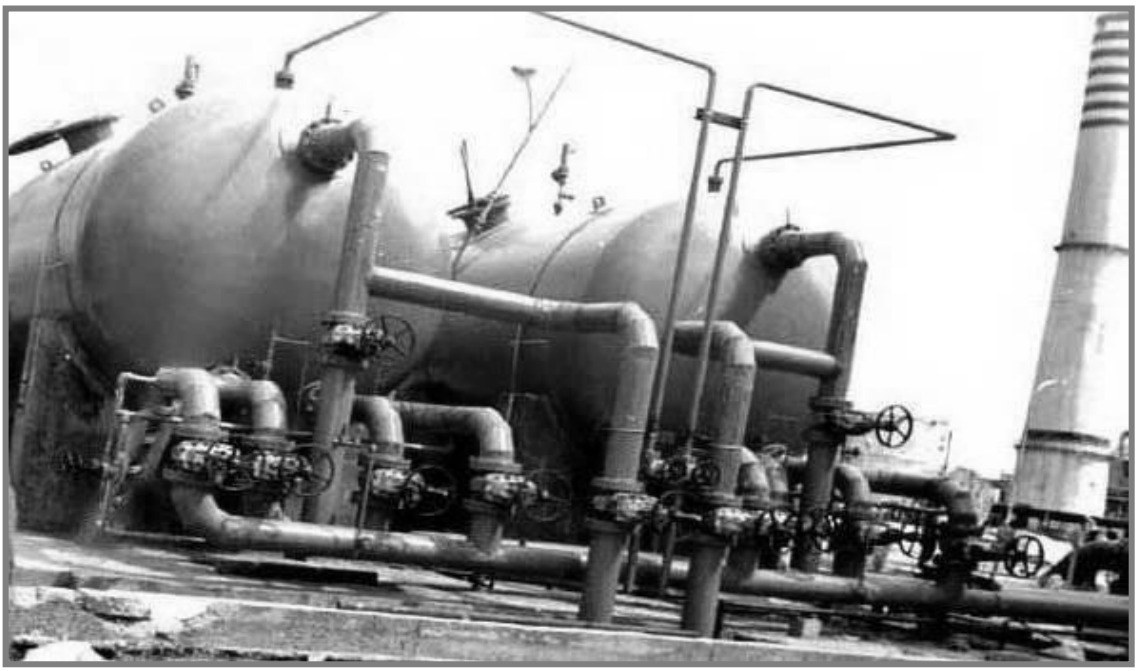
PIPING BOOK

Pipes are used to transfer the fluids from one place to another. For example, pipes are used to carry gas and water in household works.

Application of pipes and its usage in factories, large scale industries are shown below.

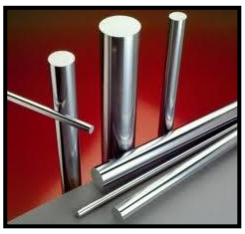


Pipe Material

Many types of pipe materials are available like stainless steel, carbon steel, chrome steel, vitrified clay, cast iron, plastic, glass etc. From the above materials, stainless steel, carbon steel, plastics are mostly used in pipes.

Stainless Steel

Carbon Steel

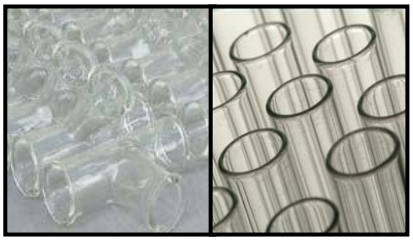


Chrome Steel

Iron

Vitrified Clay

Plastic



Glass

Pipe Sizes

Pipe sizes depends upon the fluid pressure, temperature and its velocity. As the fluid temperature, pressure & velocity are very low, small size pipes like 1/2", 3/4" diameter are moslty used for carrying water and gas in household usage. These pipes are connected by screwed fittings..

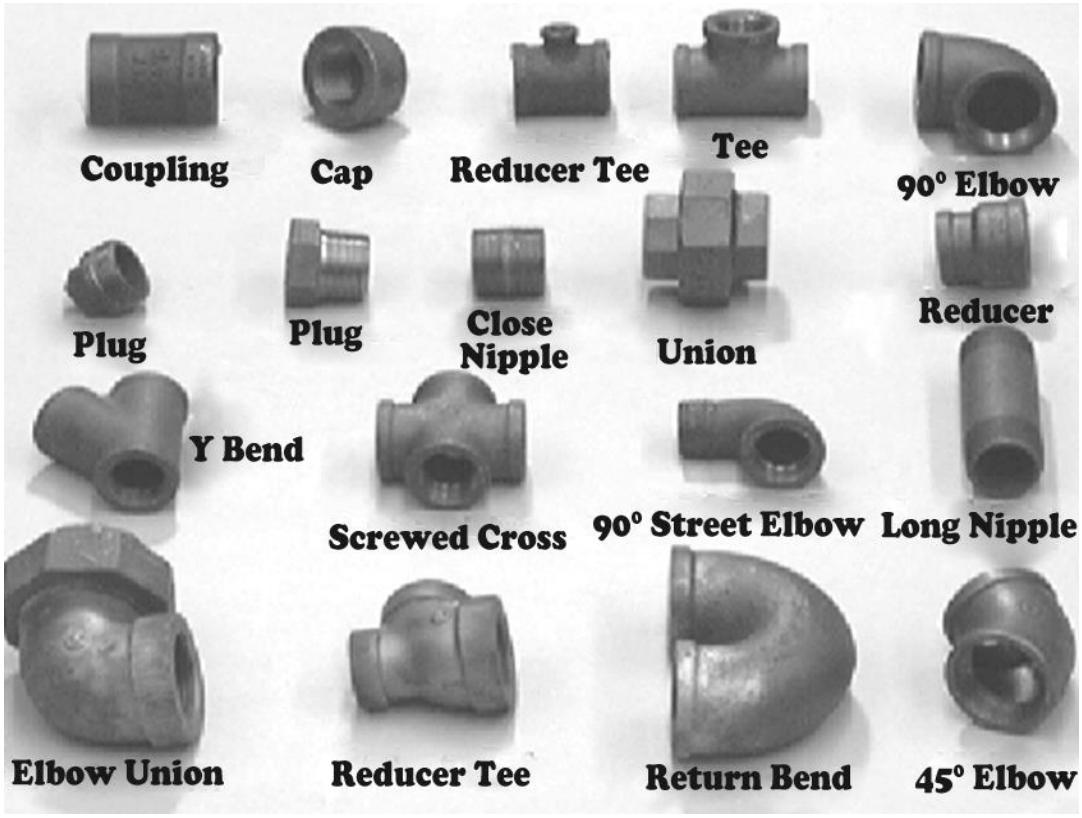
Refineries, power plant etc. uses large size pipes like 24”, 42” diameter. Here, the pipes are joined using welded connections. In these pipes, fluid pressure and temperature are very high so we cannot use screwed fittings.

As mentioned above, pipe sizes are determined by the fluid pressure, temperature and its velocity. Pipe thickness are mainly concerned with fluid pressure. Because pipes may explode if the fluid pressure exceeds its allowable limit. In order to prevent such accidents, large thickness pipes are used.

Generally, Standards are followed in manufacturing processes to determine the sizes and materials of the pipes. Standard pipes are manufactured using dies. If the required pipe size is larger than the available standard size, plates with required thickness are rolled to make those pipes.

Types of Fittings

Some of the pipe fittings are shown below



Reducer

A reducer is the component in a pipeline that reduces the pipe size from a larger to a smaller bore (inner diameter) and vice versa. As there is change in pipe sizes due to its usage, thus fluid pressure increases or decreases.

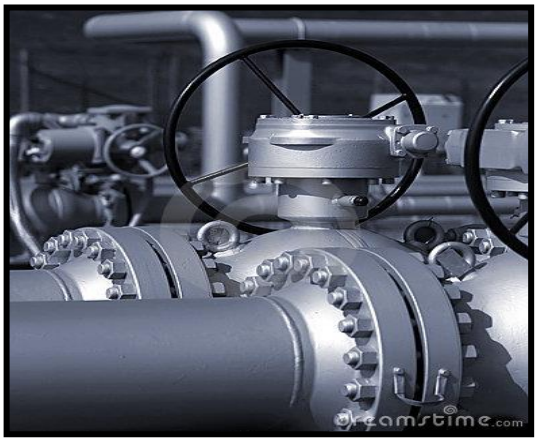
Types of Reducer

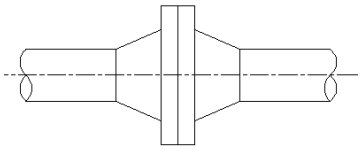
Concentric Reducer Eccentric Reducer

There are two main types of reducers i.e, concentric and eccentric. As the eccentric reducer cost is high, concentric reducer should be used whenever possible.

Flanges

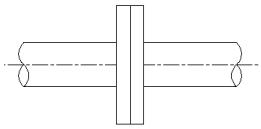
A flange is a method of connecting pipes, valves, pumps and other equipment to form a piping system. It also provides easy access for cleaning, inspection or modification. Flanges are usually welded or screwed. Flanged joints are made by bolting together two flanges with a gasket between them to provide a seal.





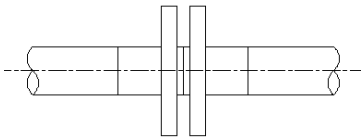
WELD NECK

WELDING NECK FLANGES



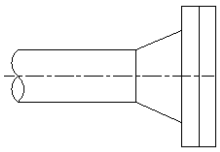
SLIP - ON

SLIP-ON FLANGES



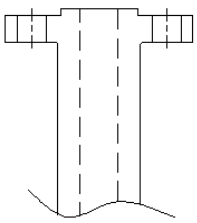
LAPPED

LAP JOINT FLANGES



BLIND

BLIND FLANGES



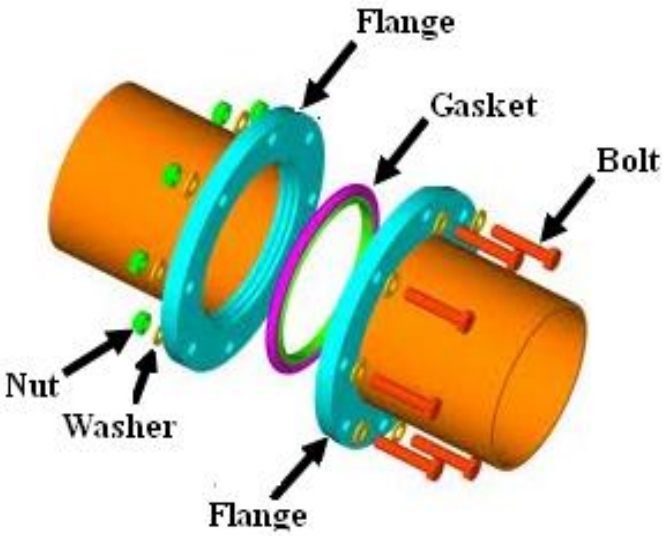
LONG WELDING NECK

PLATE FLANGES

SOCKET WELDING FLANGES

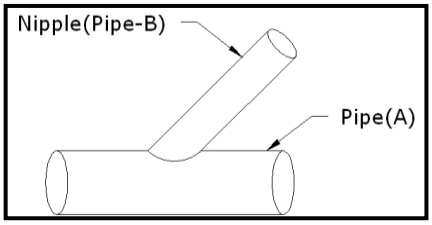
THREADED FLANGES

Types of Flanges



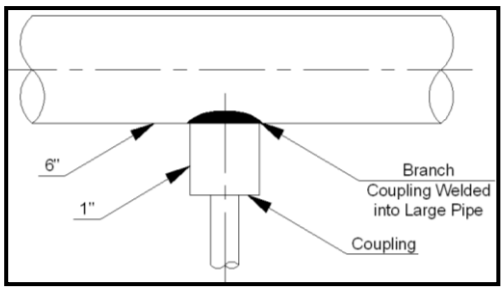
Nipple

A nipple is a fitting, consisting of a short piece of pipe, usually provided with a male pipe thread at each end, for connecting two other fittings.



Coupling

A coupling (or coupler) is a very short length of pipe or tube, with a socket at one or both ends that allows two pipes or tubes to be joined together.

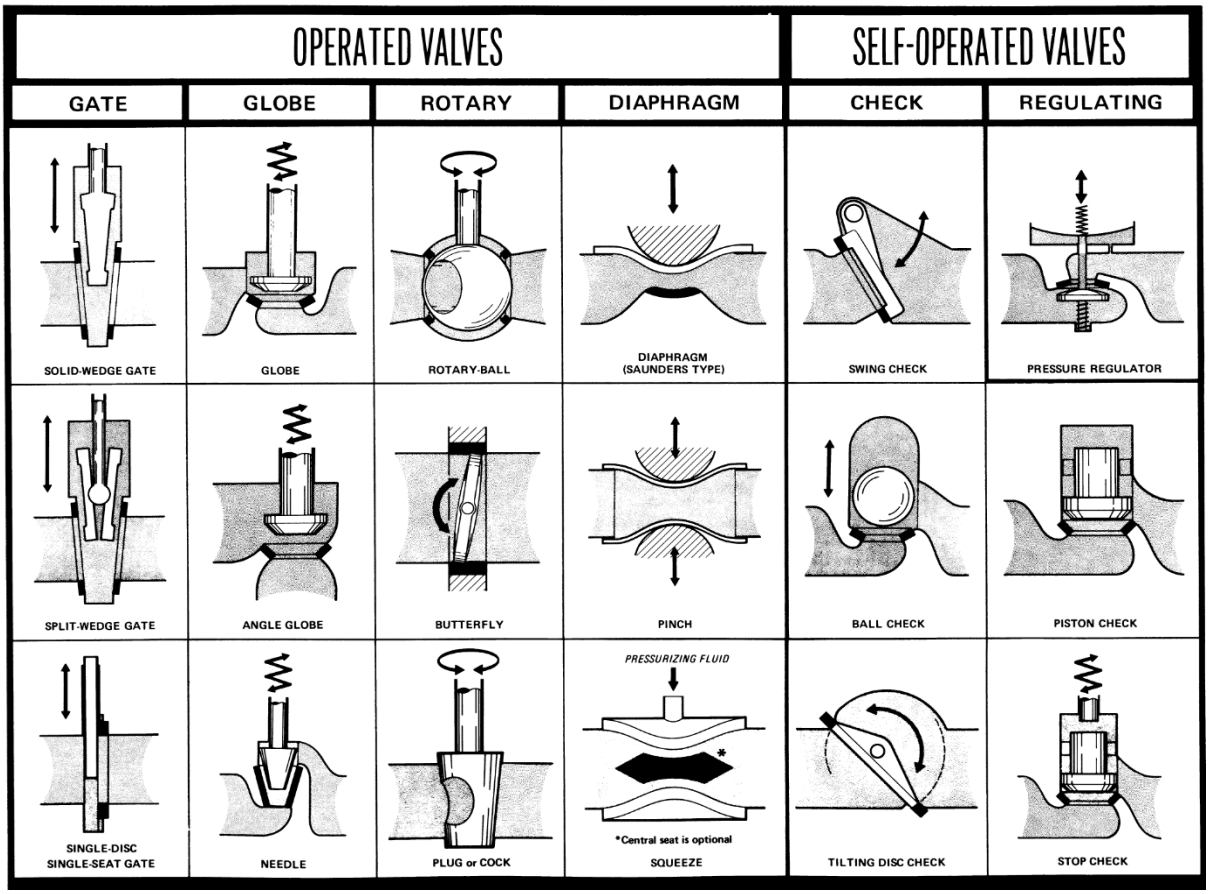


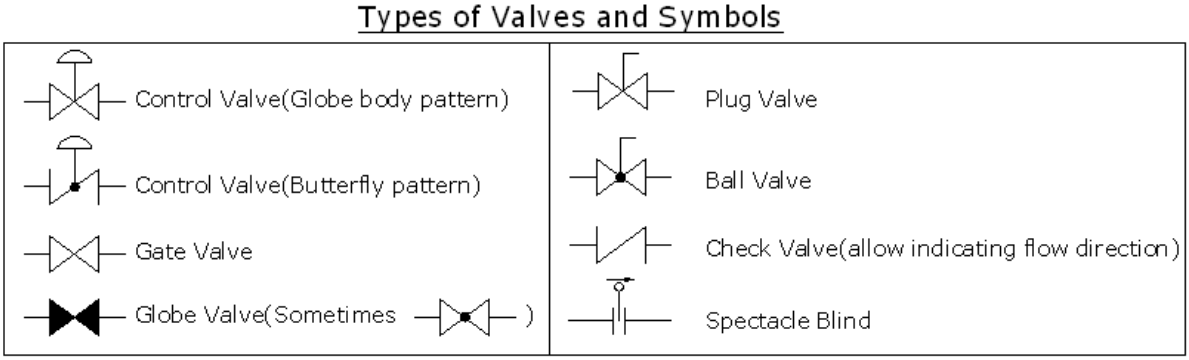
Valves

A valve is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways.There are many types of valves are shown below.

Types of valves

1. Gate valve
2. Globe valve
3. Relief valve
4. Control valve
5. Butterfly valve
6. Check valve
7. Plug valve
8. Diaphragm valve



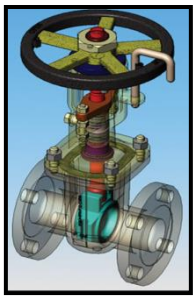


1. Gate valve

Gate valves are primarily designed to start or stop flow, and when a straight-line flow of fluid and minimum flow restriction are needed. In service, these valves generally are either fully open or fully closed.

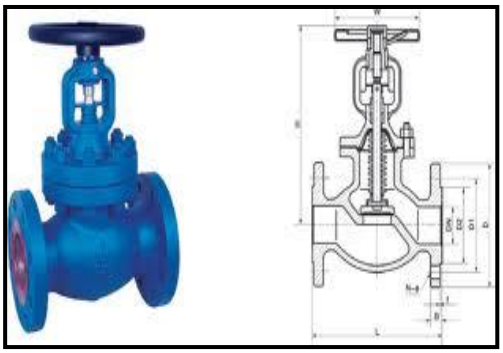
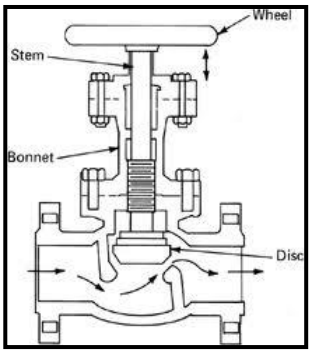
It functions by lifting a rectangular or circular gate out of the path of the fluid. When the valve is fully open, gate valves are full bore, meaning there is nothing to obstruct the flow because the gate and pipeline diameter have the same opening.





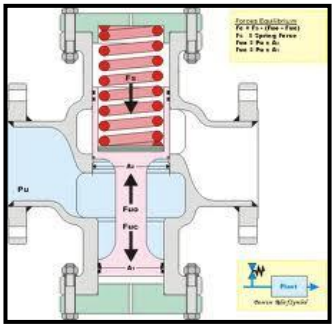
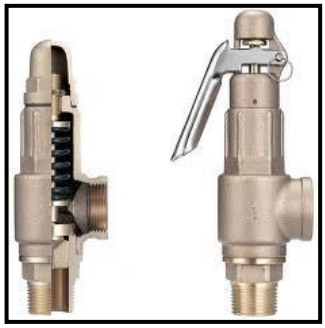
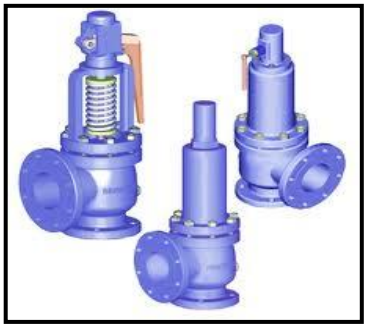
2. Globe valve

A globe valve regulates flow in a pipeline. It is used to control or stop the flow of liquid or gas through a pipe. Globe valves are named for their spherical body shape with the two halves of the body being separated by an internal baffle. Globe valves are also known as throttle valves.

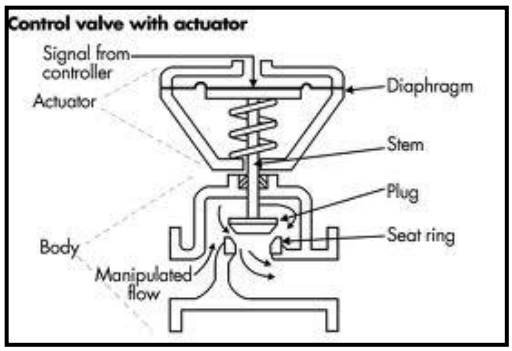
3. Relief valve and safety valve

Pressure relief valves (safety relief valves) are designed to open at a preset pressure and discharge fluid until pressure drops to acceptable levels.

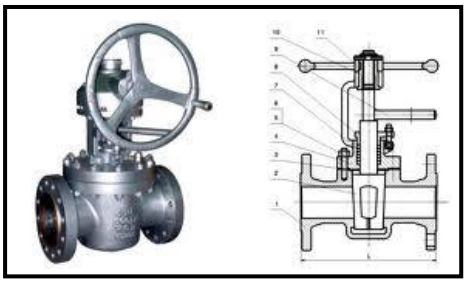
4. Control valve

A control valve is a valve used to control fluid flow by varying the size of the flow passage as directed by a signal from a controller. This enables the direct control of flow rate and the consequential control of process quantities such as pressure, temperature, and liquid level.



5. Plug valve

Plug valves are valves with cylindrical or conically tapered "plugs" which can be rotated inside the valve body to control flow through the valve. The plugs in plug valves have one or more hollow passageways going sideways through the plug, so that fluid can flow through the plug when the valve is open.

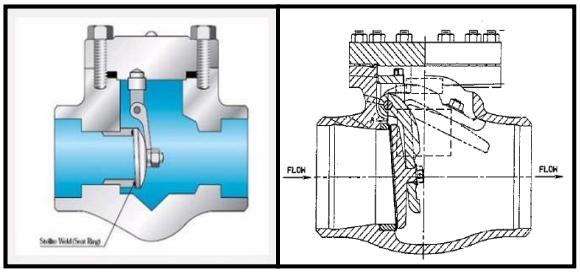


6. Ball valve

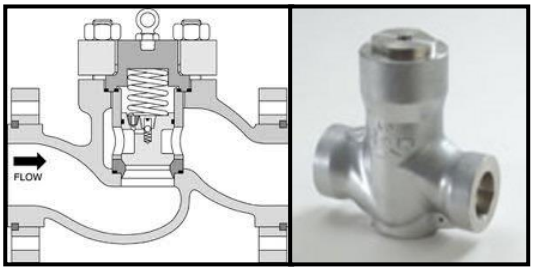
A ball valve is a form of quarter-turn valve which uses a hollow, perforated and pivoting ball to control flow through it. It is open when the ball's hole is in line with the flow and closed when it is pivoted 90-degrees by the valve handle.

7. Check valve

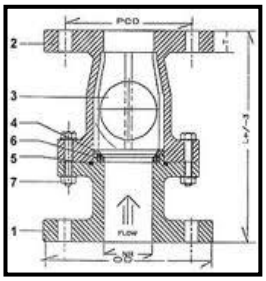
A check valve is a flow-monitoring device typically used in pipeline systems to allow a fluid to flow in only one direction and prevent backflow or backwash.



Swing Check



Piston Check Valve



Ball Check Valve

Butterfly Check Valve

8. Butterfly valve

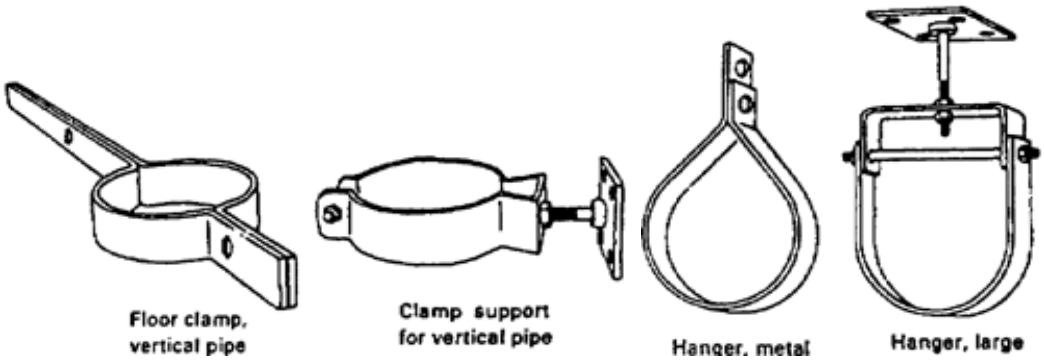
A butterfly valve is a valve that isolates or regulates the flow of a fluid. The closing mechanism is a disk that rotates.

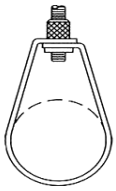
Caps

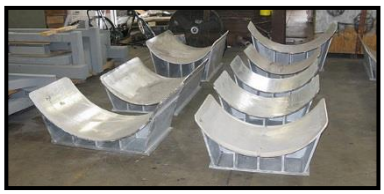
Caps are used to close the end of the pipes. Size of the caps depends on the pipe size.

Supports

A pipe support or pipe hanger is a designed element that transfer the load from a pipe to the supporting structures. Eg: clamp, saddle, lug etc.

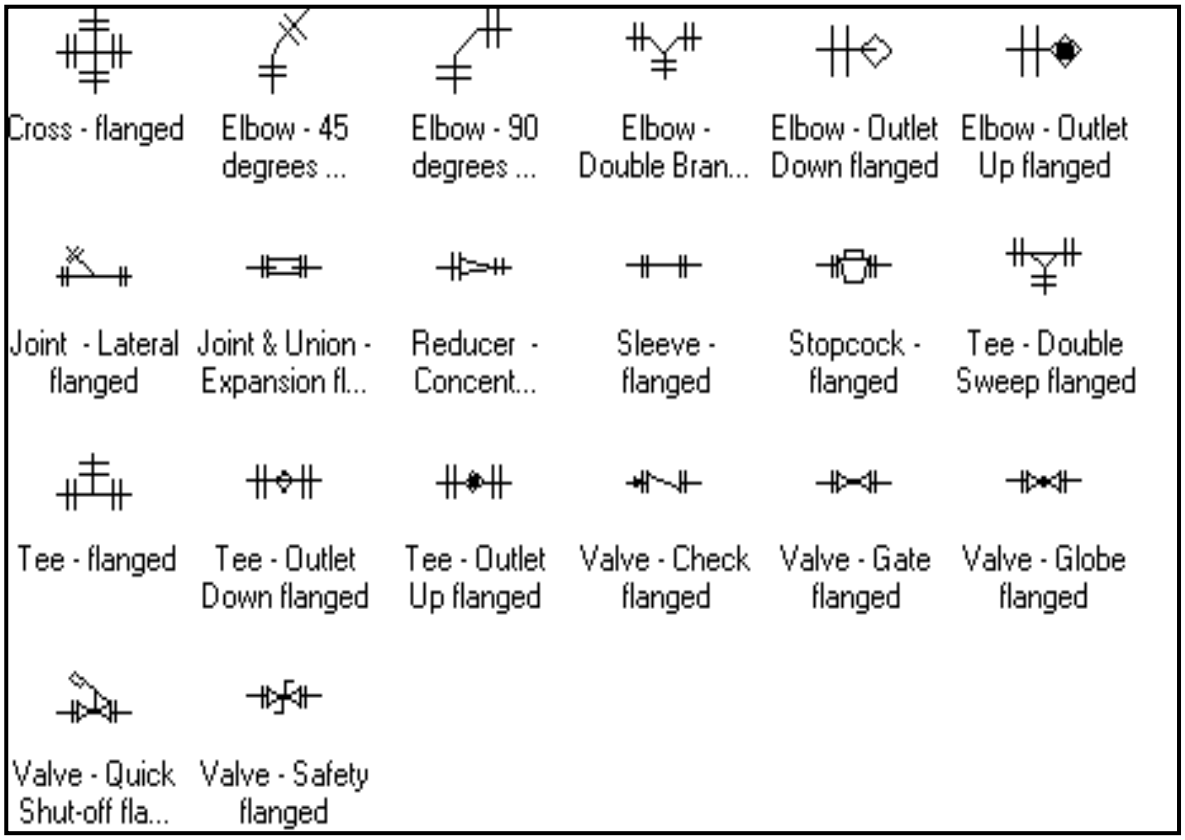






Saddle

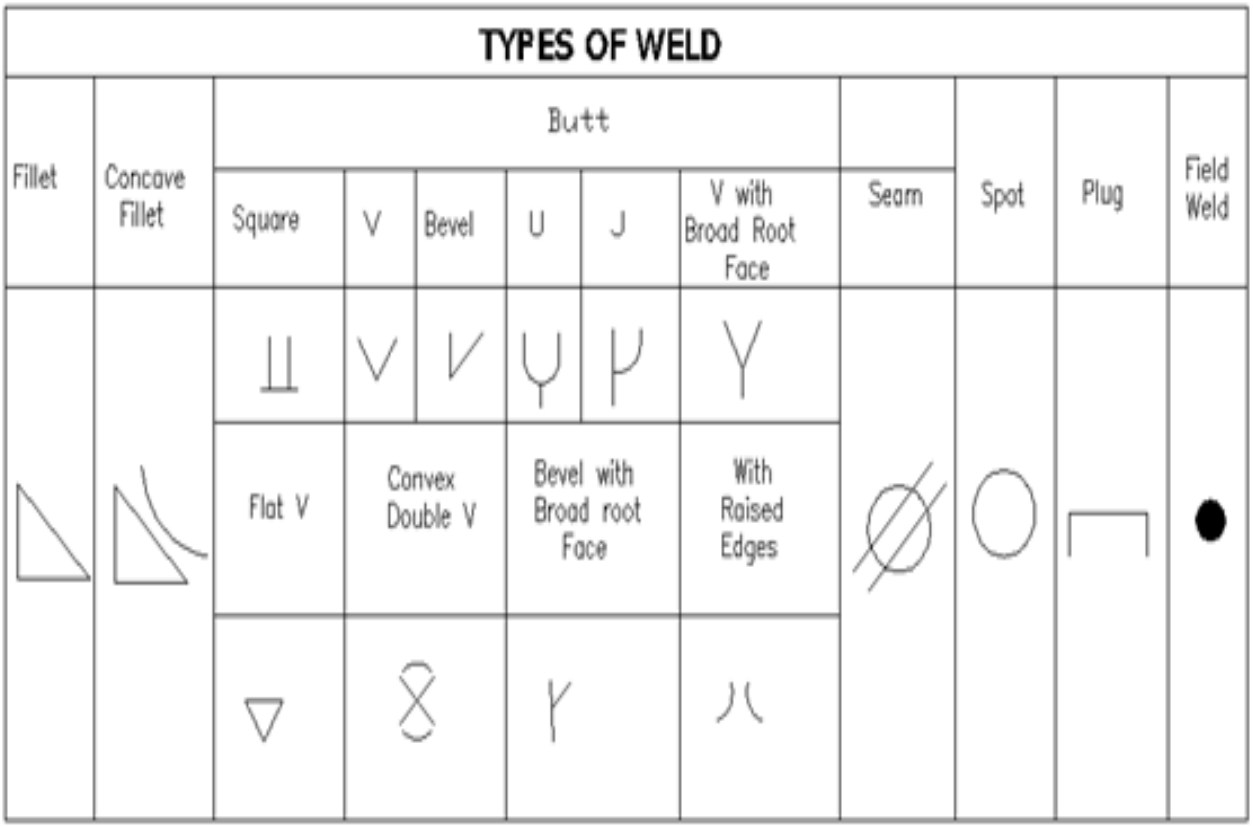
Pipe Fitting symbols



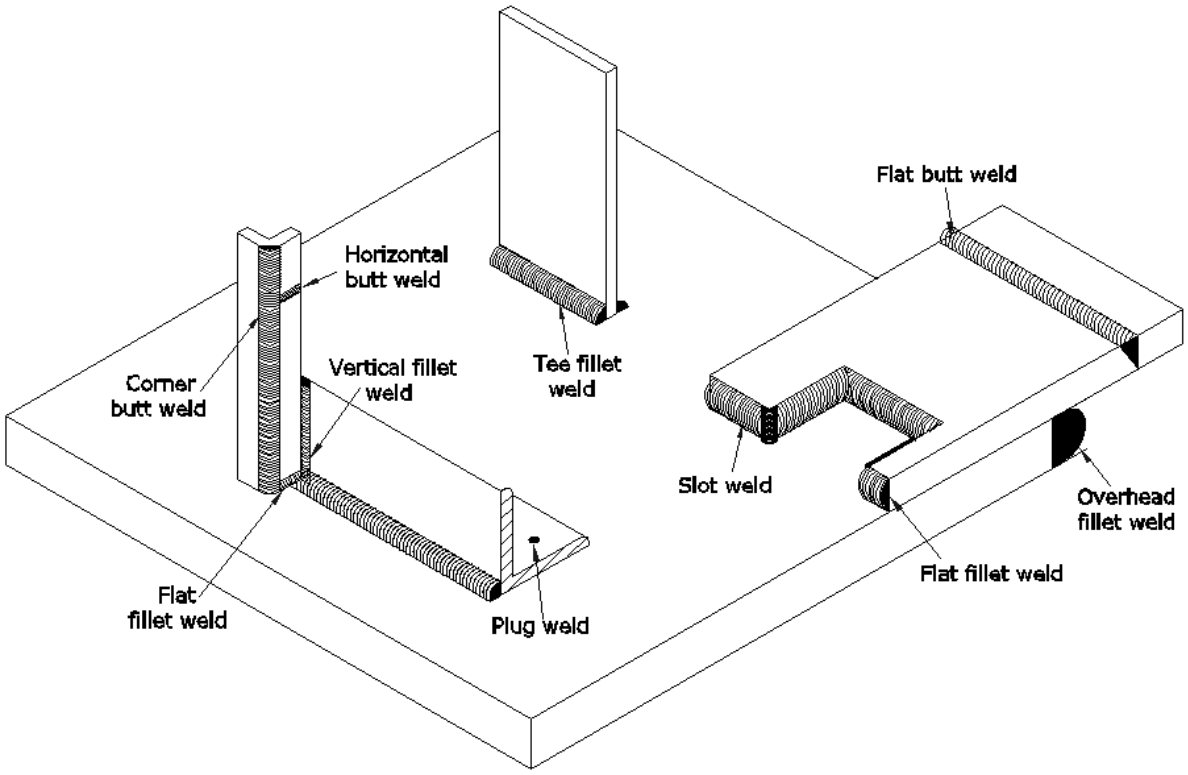
Welding

Welding is the process of joining together two pieces of metal by heating the surfaces to the point of melting so that bonding takes place at their original boundary surfaces.

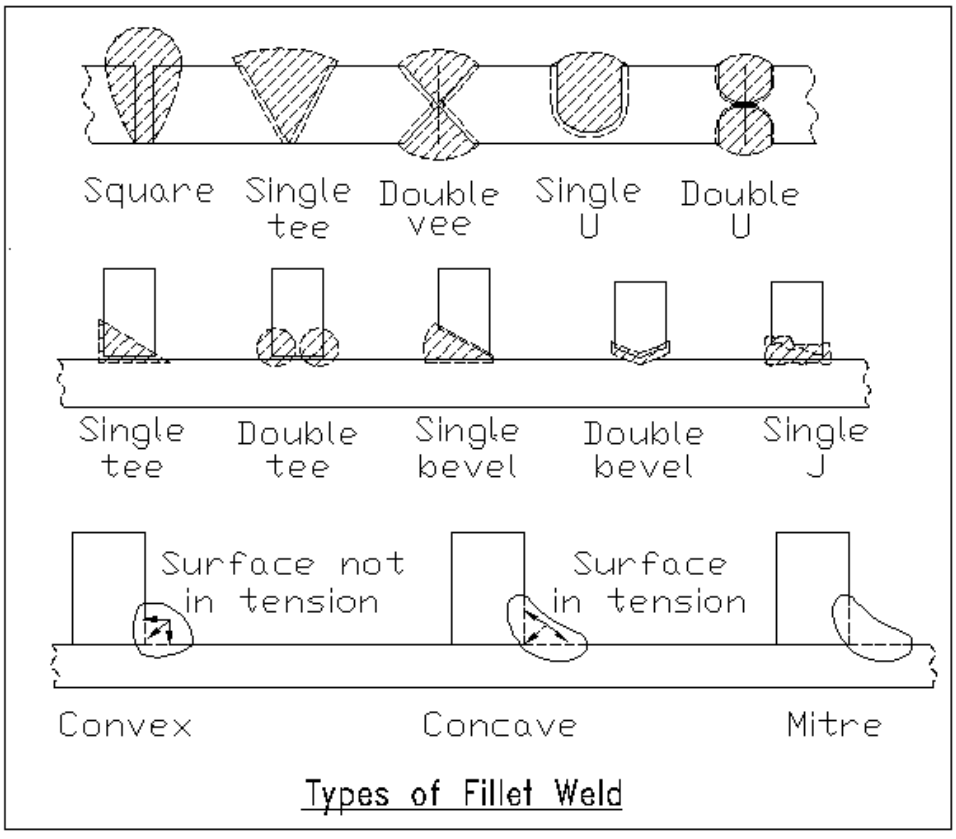
Types of Weld Symbols



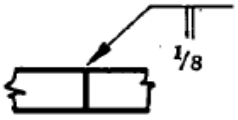
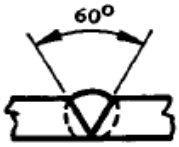
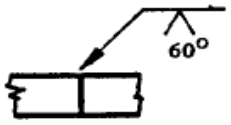
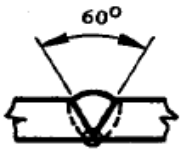
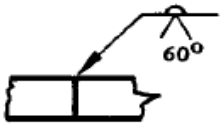
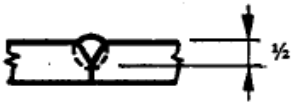
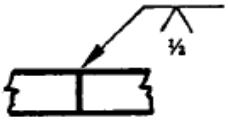
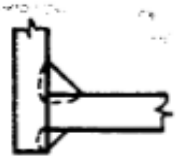
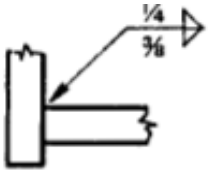
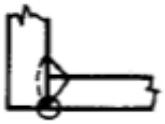
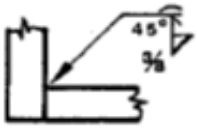
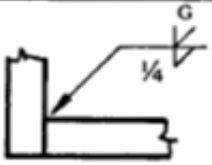
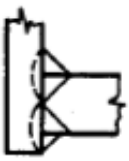
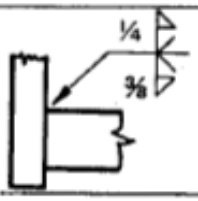
Types and position of welds

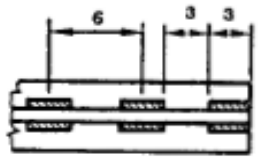
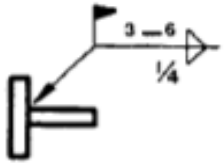
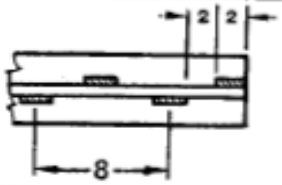
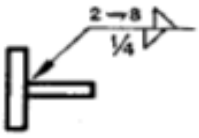
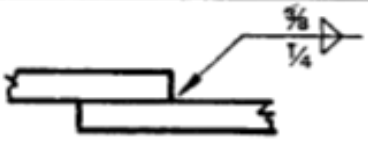
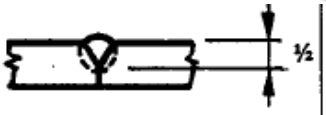
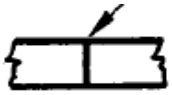
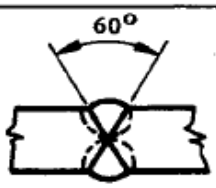
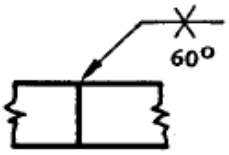
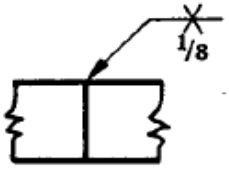
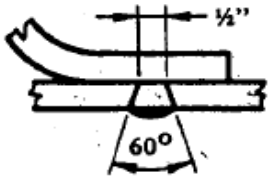
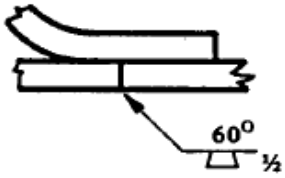
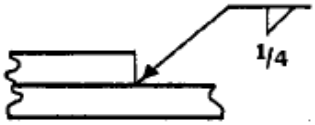


Types of Fillet Welds



APPLICATION OF WELDING SYMBOLS

WELD	SYMBOL	MEANING OF SYMBOL
		SYMBOL INDICATES SQUARE GROOVE WELD ON ARROW SIDE. ROOT GAP 1/8 IN.
		SYMBOL INDICATES V-GROOVE WELD WITH AN ANGLE OF 60 DEGREES ON ARROW SIDE
		SYMBOL INDICATES V-GROOVE WELD WITH AN ANGLE OF 60 DEGREES ON ARROW SIDE AND BEAD-TYPE BACK WELD ON THE OTHER SIDE
		SYMBOL INDICATES 1/2 IN. V-GROOVE WELD
		SYMBOL INDICATES 3/8 IN. FILLET WELD ON ARROW SIDE AND 1/4 IN. FILLET WELD ON THE OTHER SIDE
		SYMBOL INDICATES BEVEL GROOVE WITH AN ANGLE OF 45 DEGREES, 3/8 FILLET WELD ON ARROW SIDE AND BEAD TYPE BACK WELD ON OTHER SIDE
		SYMBOL INDICATES 1/4 IN. FILLET WELD ON ARROW SIDE AND BEVEL GROOVE WELD ON OTHER SIDE GRIND FLUSH ON OTHER SIDE
		SYMBOL INDICATES BEVEL GROOVE WELD AND 3/8 FILLET WELD ON ARROW SIDE, BEVEL GROOVE AND 1/4 FILLET WELD ON OTHER SIDE
		SYMBOL INDICATES WELD ALL AROUND 1/4 IN. FILLET WELD

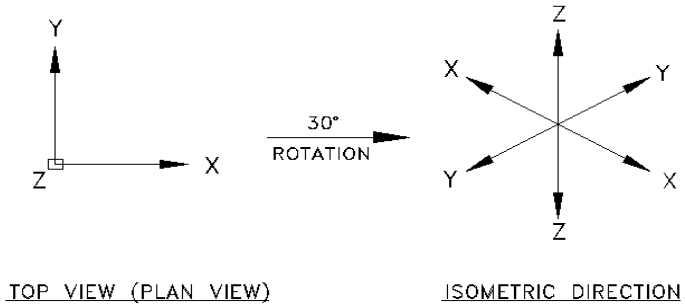
		SYMBOL INDICATES 1/4 IN. INTERMITTENT FILLET WELDS EACH 3 IN. LONG AND SPACED ON 6 IN. CENTERS. FIELD WELDED
		SYMBOL INDICATES 1/4 IN. INTERMITTENT FILLET WELD. EACH 2 IN. LONG AND SPACED ON 8 IN. CENTERS. THE WELDS ARE STAGGERED.
		SYMBOL INDICATES 1/4 IN. FILLET WELD ON ARROW SIDE AND 3/8 FILLET WELD ON OTHER SIDE
		SYMBOL INDICATES 1/2 IN. V-GROOVE WELD
		SYMBOL INDICATES V-GROOVE WELD ON ARROW SIDE AND ON OTHER SIDE WITH AN ANGLE OF 60 DEGREES
		SYMBOL INDICATES V-GROOVE WELD ON ARROW SIDE AND ON OTHER SIDE WITH A ROOT OPENING OF 1/8 IN.
		SYMBOL INDICATES PLUG WELD OF 1/2 IN. DIAMETER AND WITH AN ANGLE OF 60 DEGREES
		SYMBOL INDICATES 1/4 IN. FILLET WELD

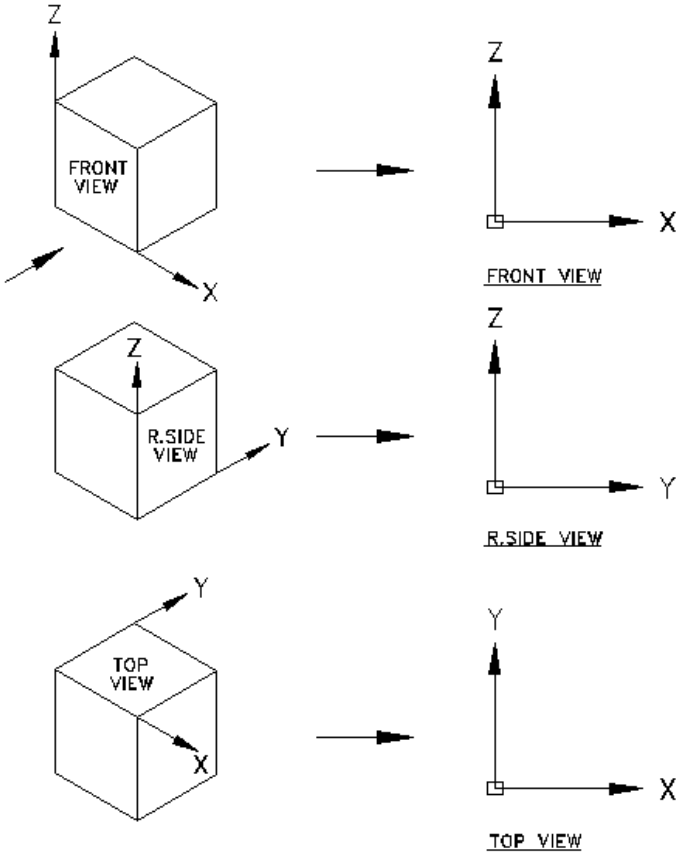
2D-View

A Drawing which shows only one view of an object is called 2D view. It is composed of only two dimensions. Eg: length and width but no depth.

Isometric view

A Drawing which shows all the three views of an object. All the vertical lines are drawn vertically but all horizontal lines should be drawn at 30 degrees to the base line. This degree is also called as Isometric Degree (30°).



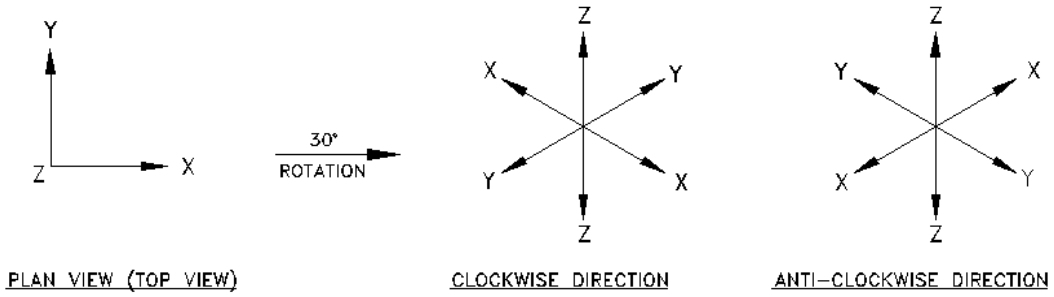


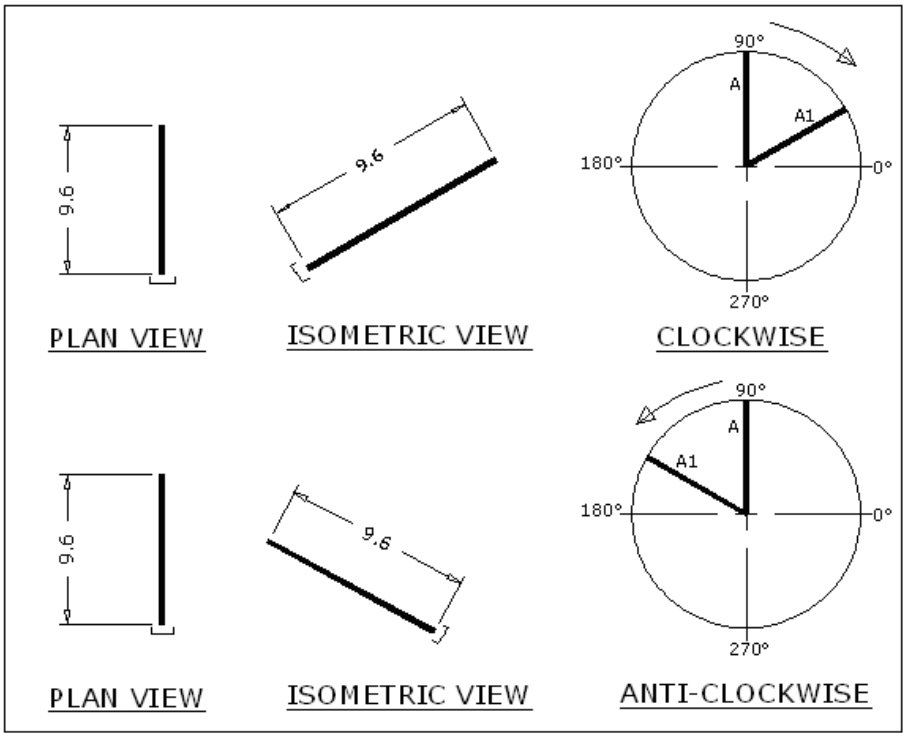
Routing

Pipe routing is the planning of pipeline layout, which includes considerations of neatness, economy, and safety.

Types of routing

1. Clockwise
2. Anti- Clockwise



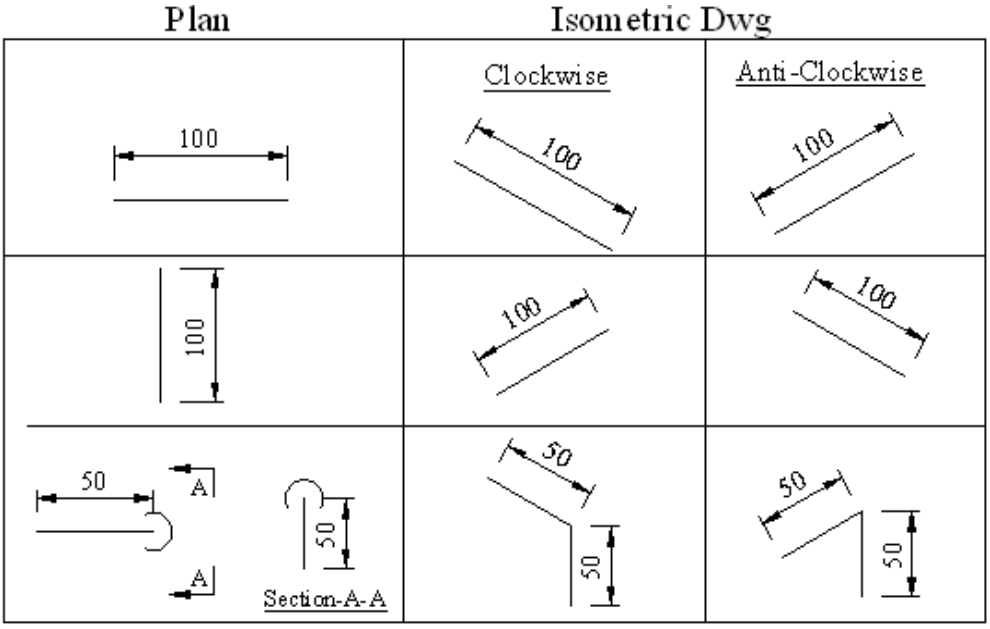


Plan = Top View

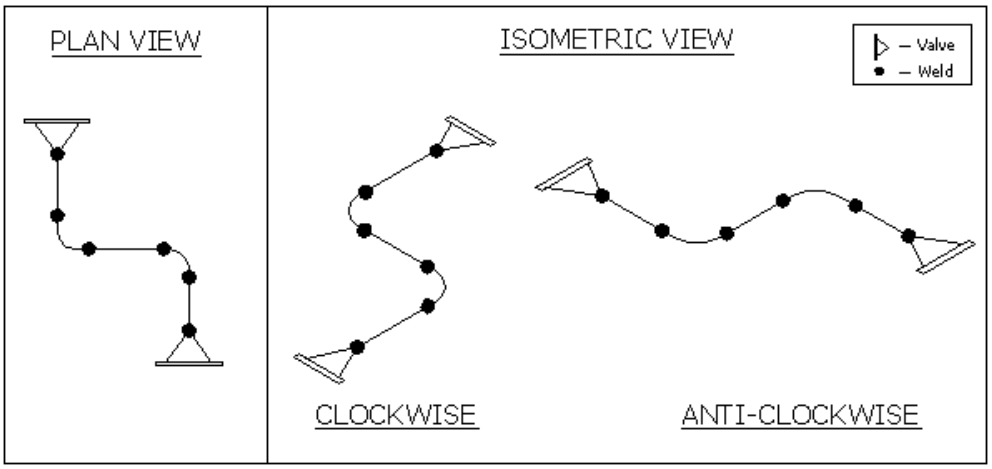
Elevation = Front View

Model Drawing

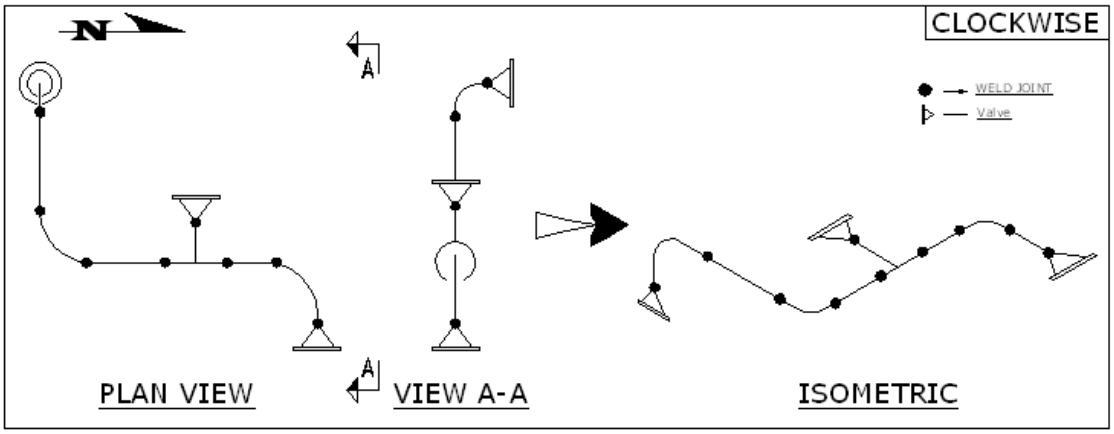
1.

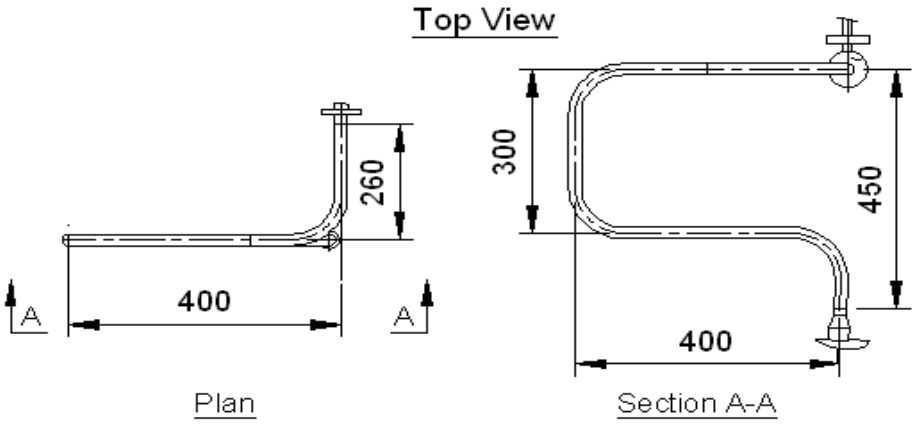


2.

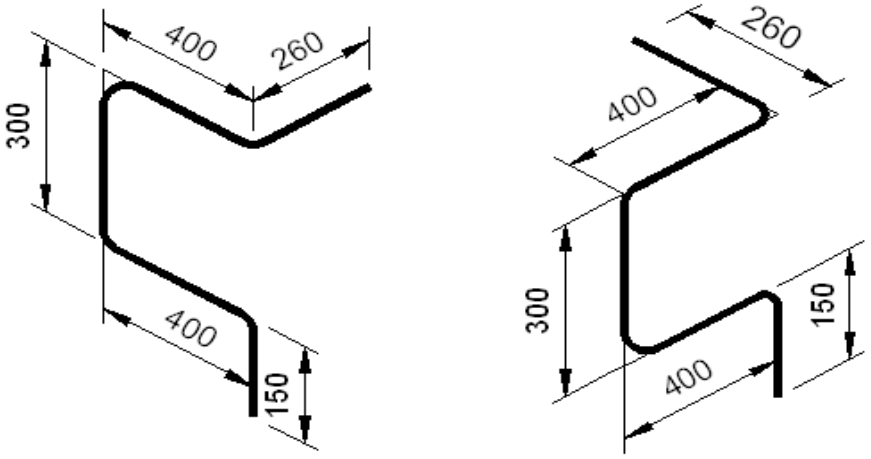


3.

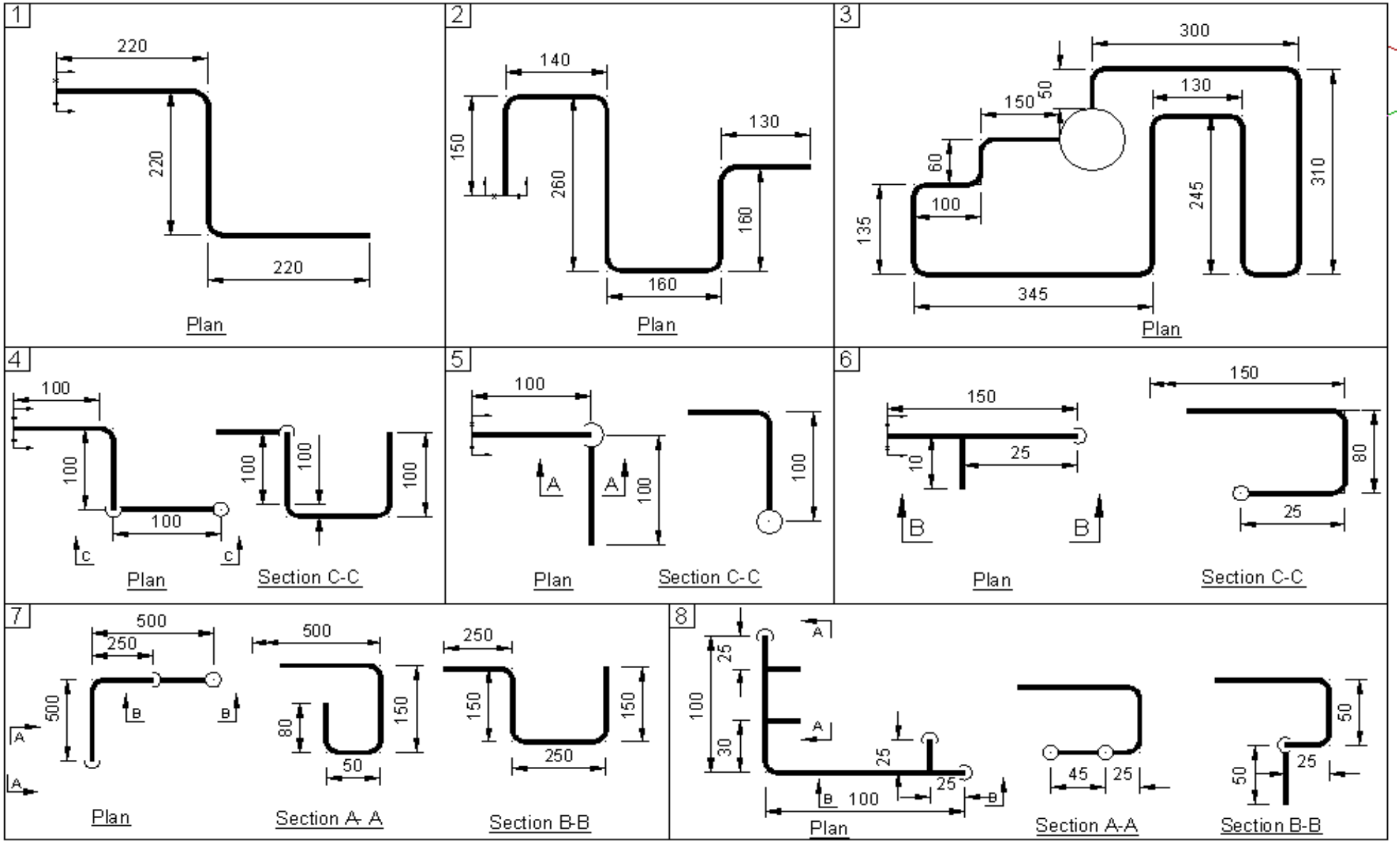




Routing (Isometric View)



DRAWING PRACTICE



Hatch

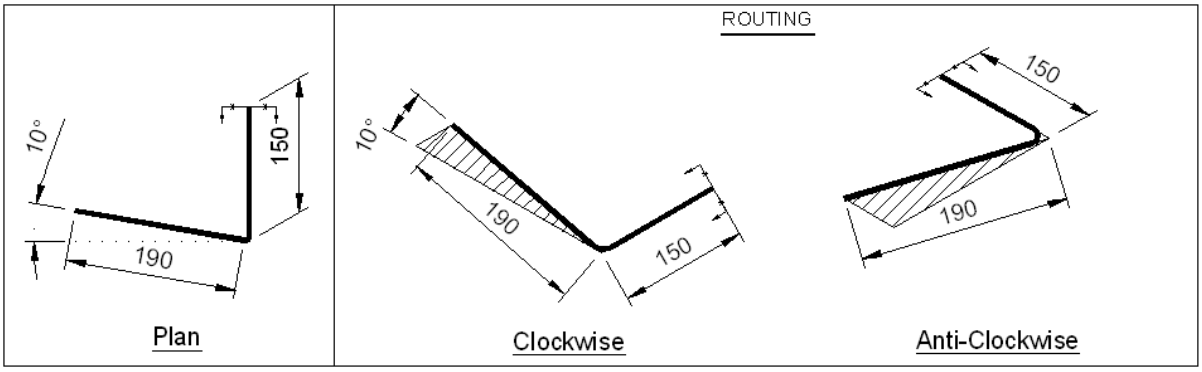
Hatches on isometric drawings are applied, to indicate that a pipe runs at a certain angle and in which direction the pipe runs.

This certain angle is mentioned as slope & it is of two types.

i.e, Horizontal slope and Vertical slope.

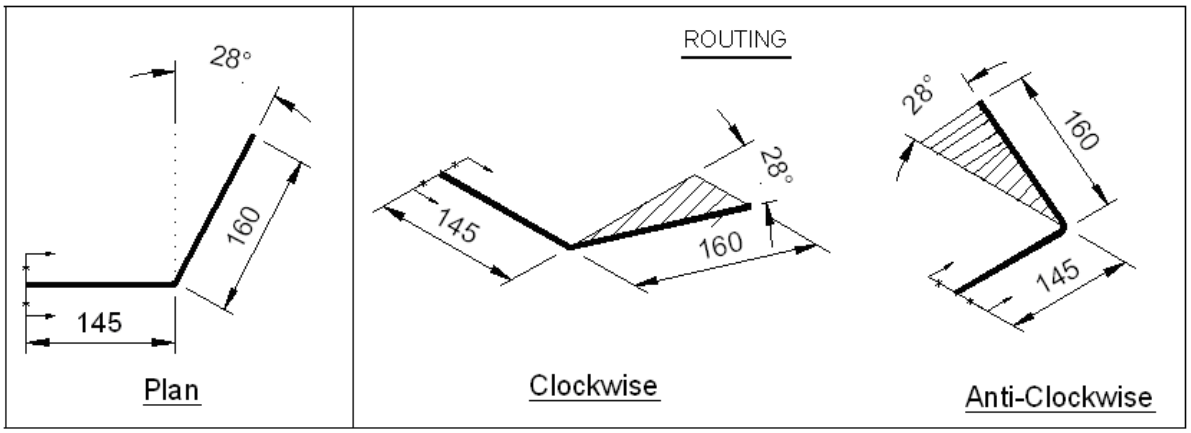
Horizontal slope

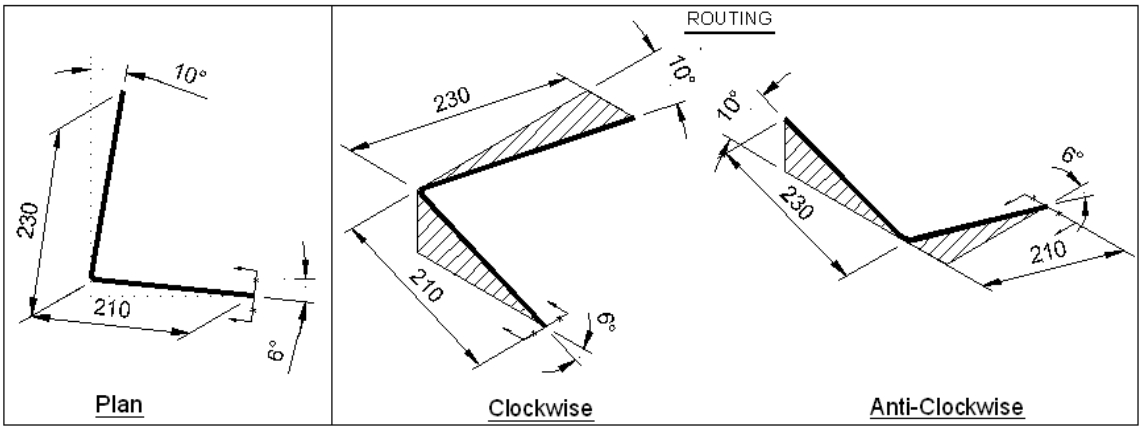
When the horizontal pipe runs at a certain angle, then the hatch used is called as horizontal slope.



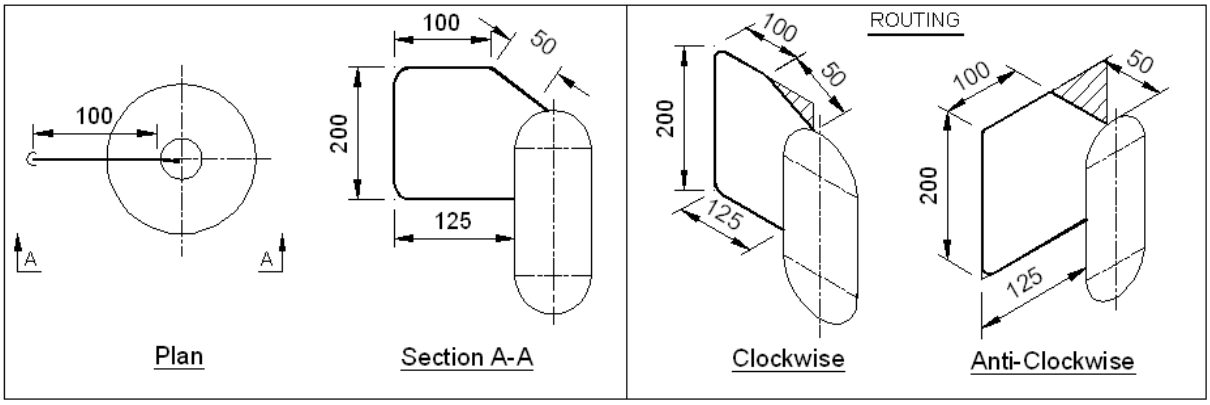
Vertical slope

When the vertical pipe runs at a certain angle, then the hatch used is called as vertical slope.



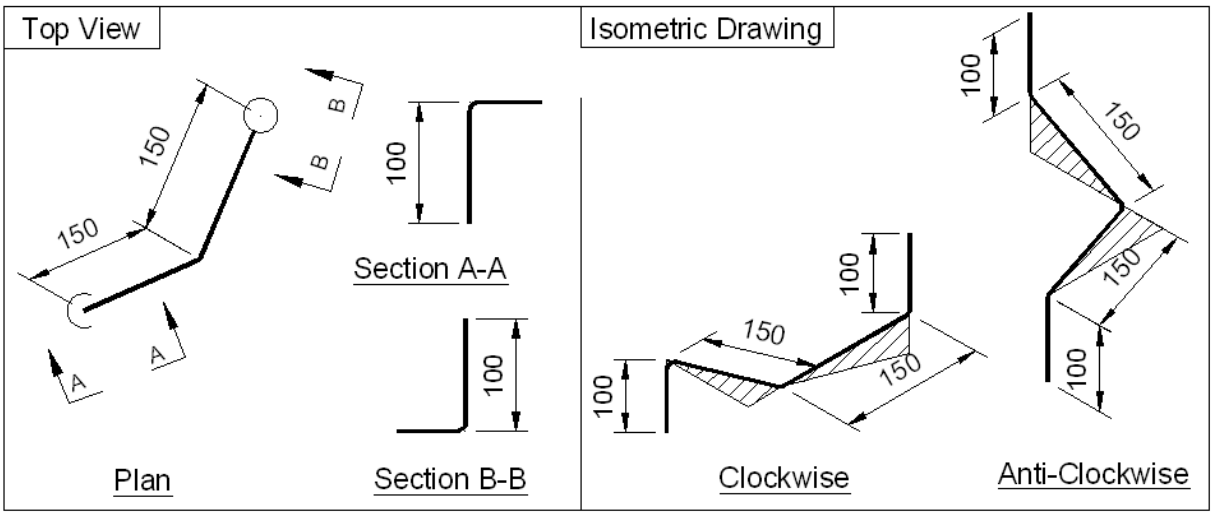


Horizontal and Vertical Slope

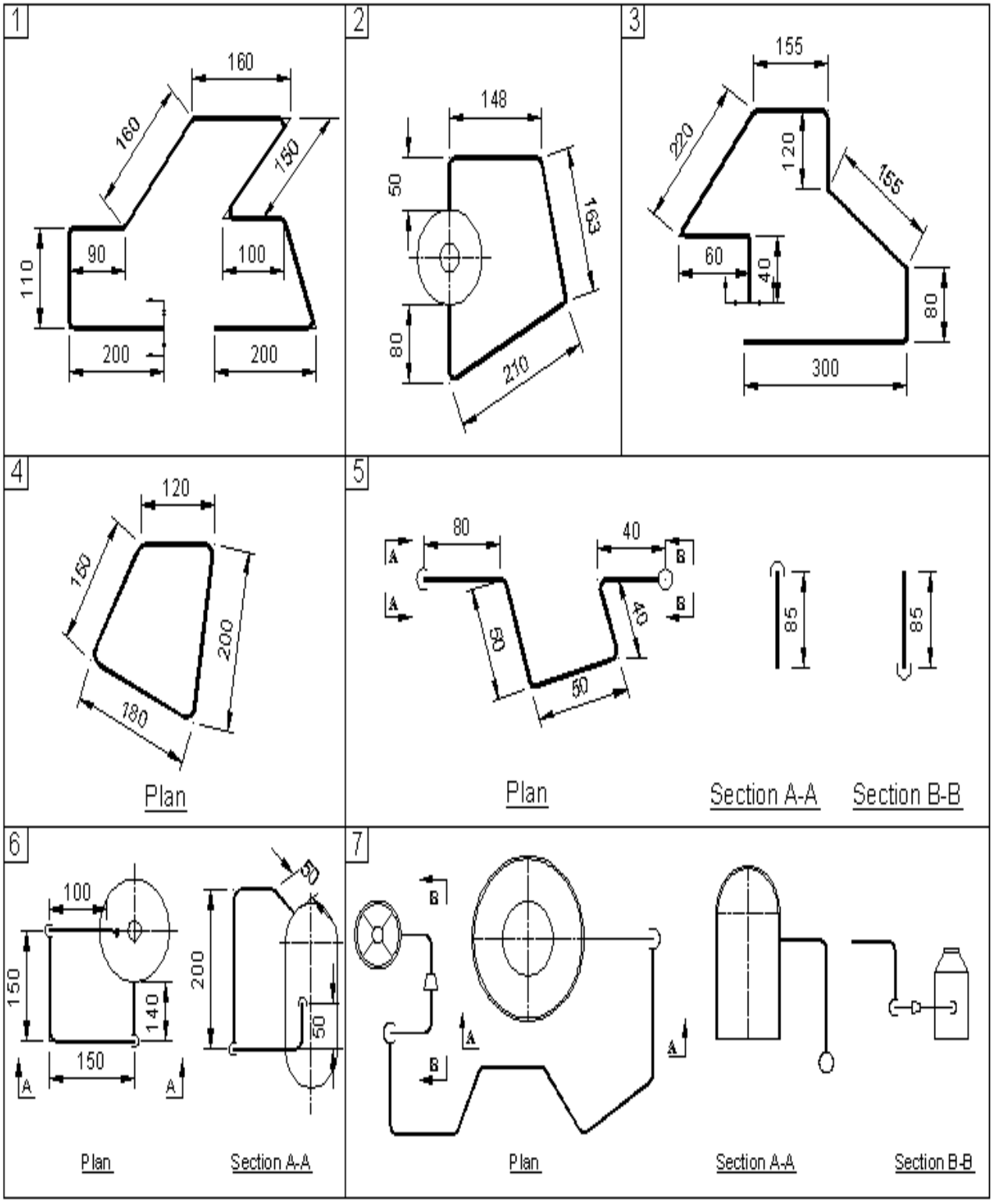


Z- Axis (Slope Direction)

Model Drawing

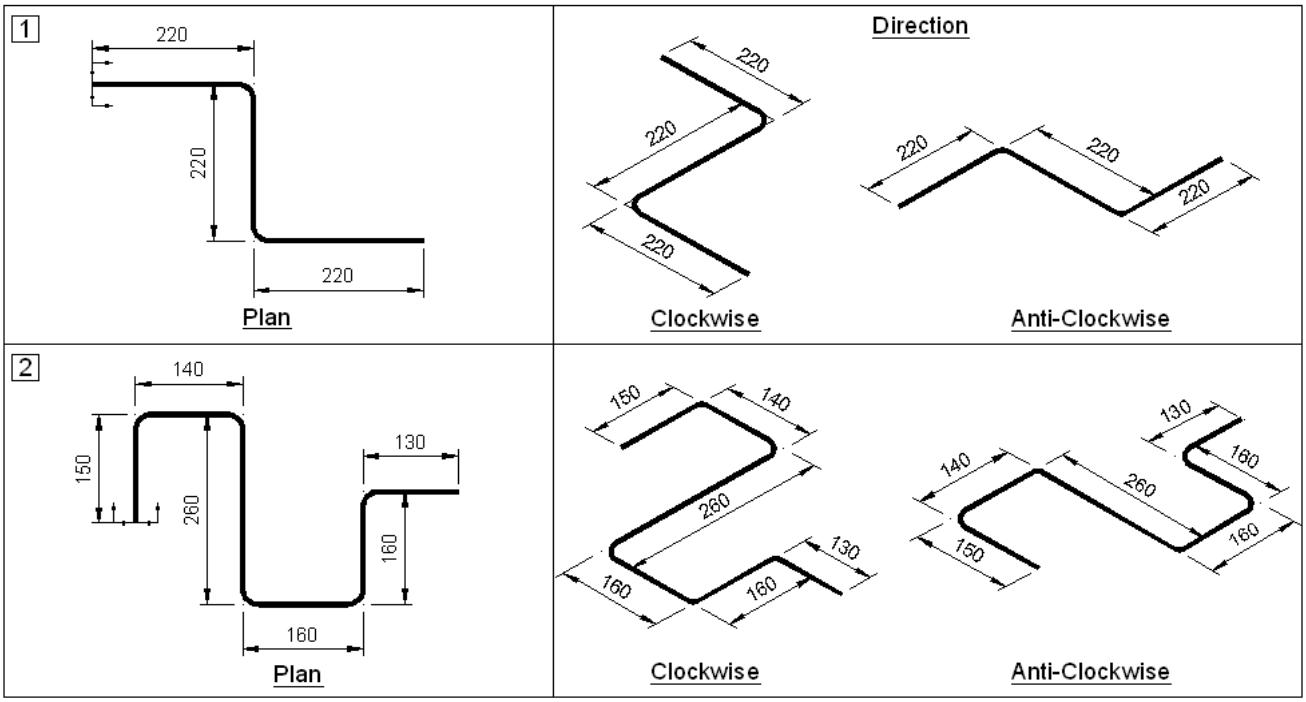


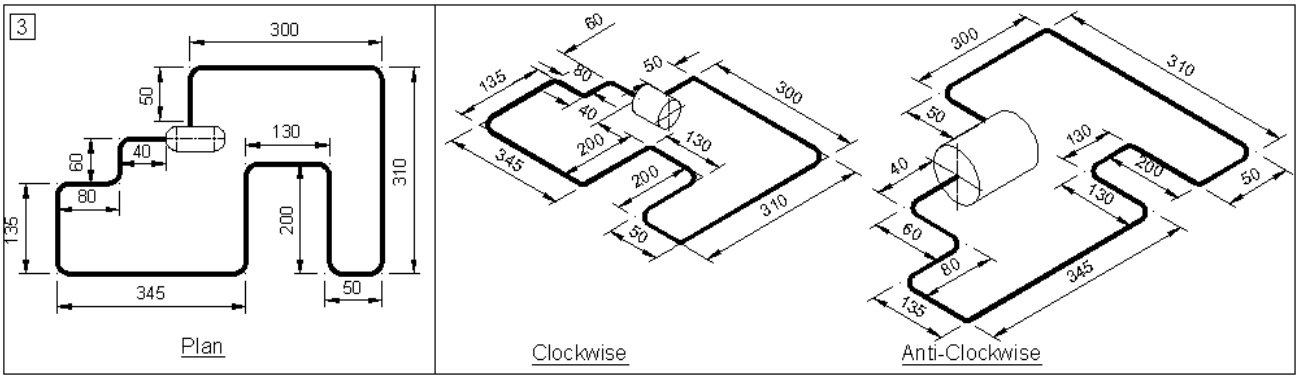
Drawing Practice

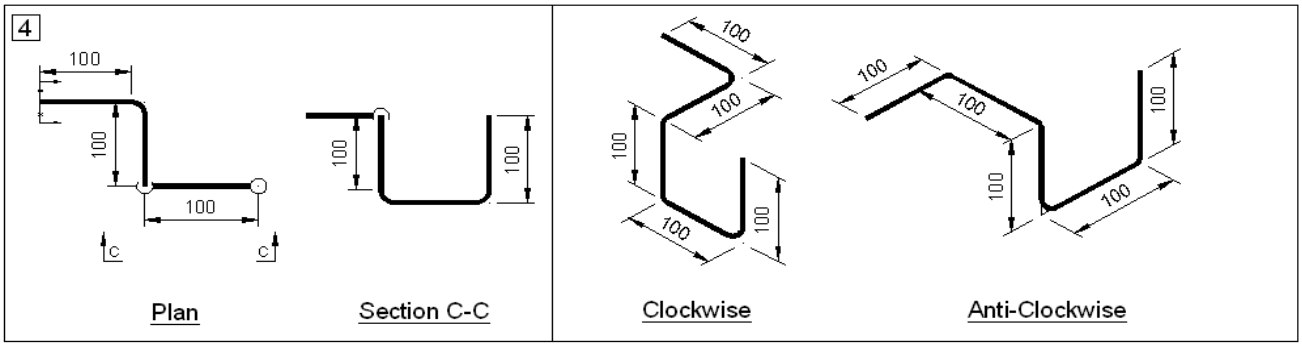


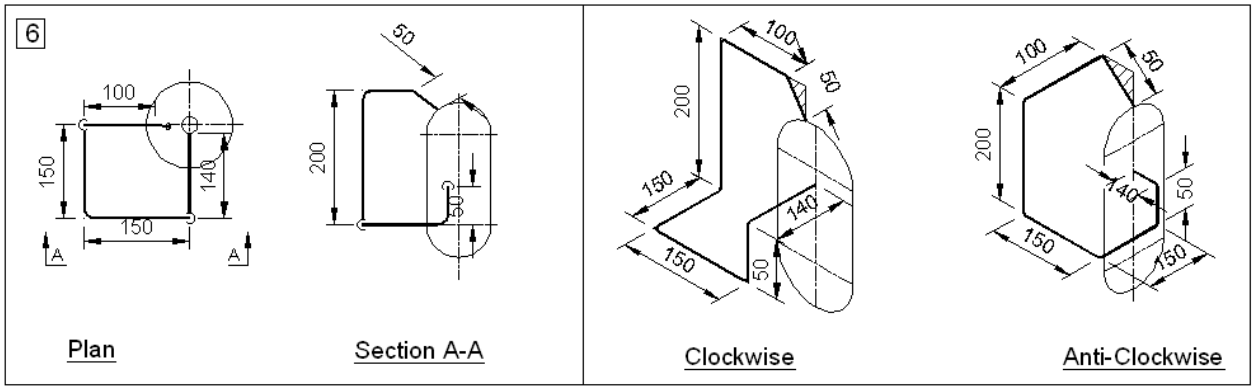
Routing

I) **Drawing Practice:-**

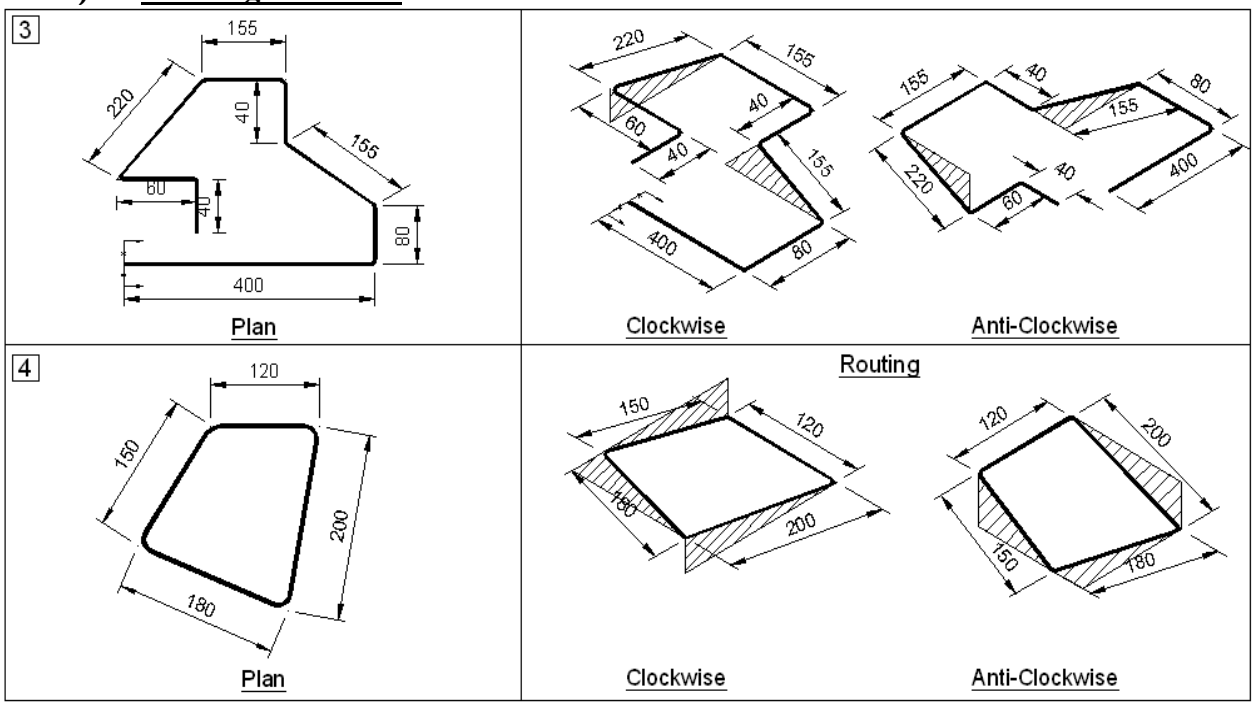


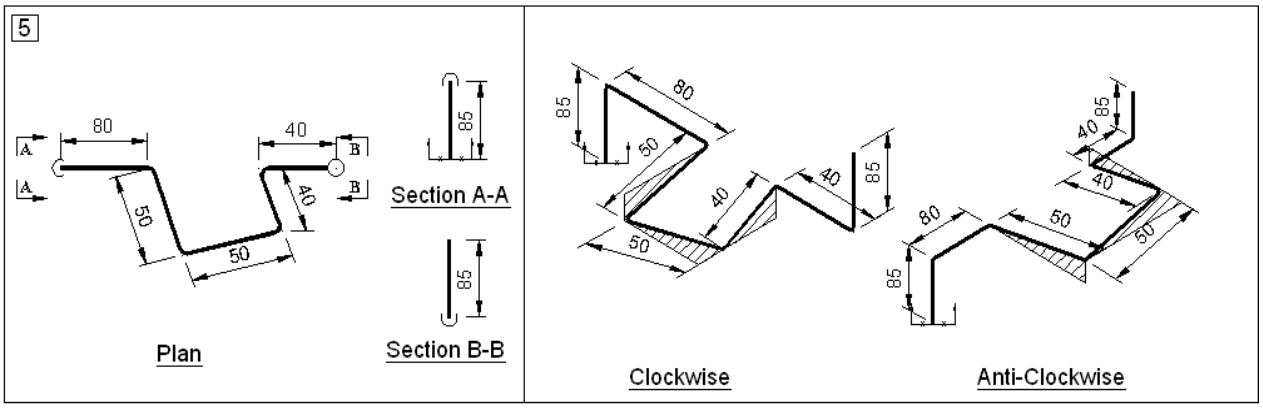


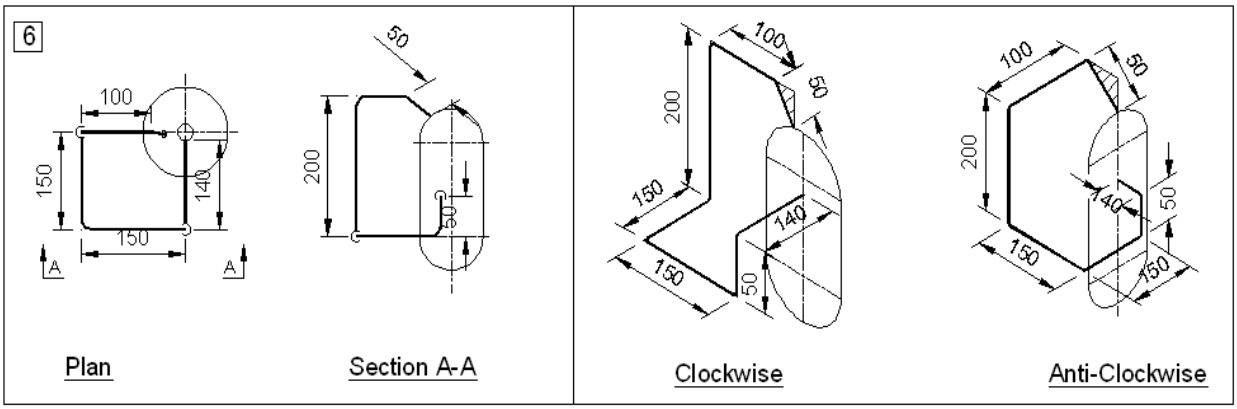


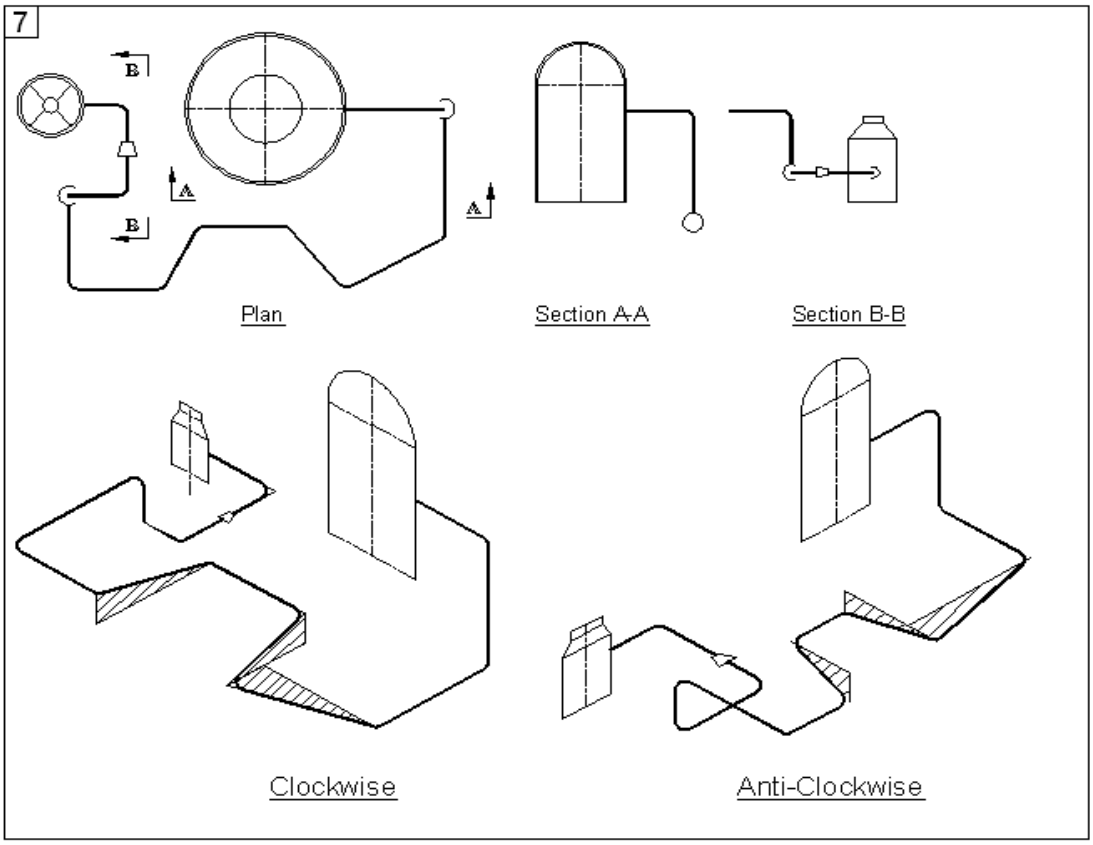


II.) Drawing Practice:-



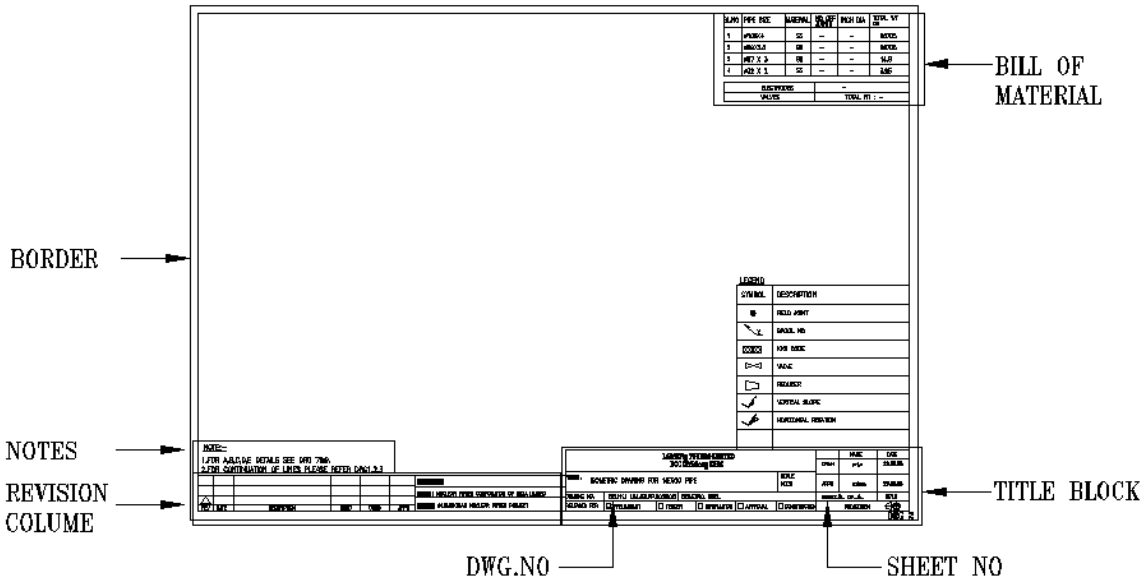



6
100
150
140
150
A
A
50
200
50
Plan
Section A-A
100
50
200
150
140
150
50
100
50
200
140
50
150
150
Clockwise
Anti-Clockwise


7
B
A
B
A
Plan
Section A-A
Section B-B
Clockwise
Anti-Clockwise

Drawing Details

Drawing Sheet



NTS: (Not to scale)

If a drawing is drawn roughly to fit into the given sheet size and the dimensions are edited manually, then it denotes that the drawing is in NTS. In other words, NTS indicates that the drawing is not present in its original dimensions.

Notes

In the drawing, the following note is given whether in notes section or in any other corner

All dimension in MM

All dimension in M

(OR)

NTS is noted on title block

The drawing should be in any one of the above mentioned units (MM, M, NTS)

Isometric

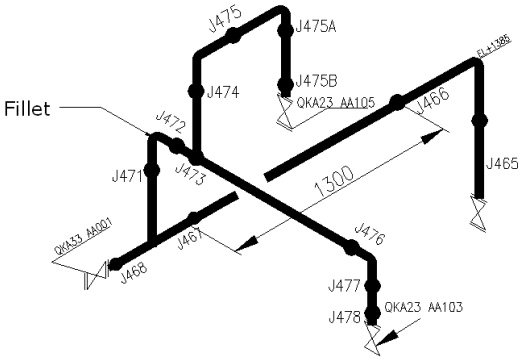
Isometric projection is a method for visually representing three-dimensional objects in two dimensions

Pline

In isometric drawing, pline (polyline) command is used to specify the pipe routing. To differentiate the pipe sizes, width option in polyline command is used.

Fillet

Fillet command is used to show the bends present in the piping.



Dotted line

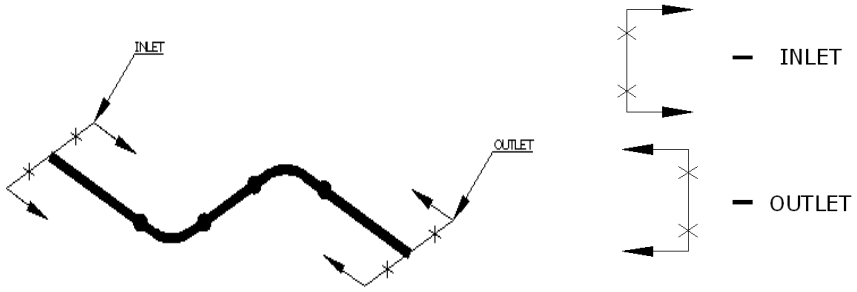
Faint line or object should be shown in dotted lines

Connected pieces and maximum pipe length

As it is quite difficult to carry huge length pipes to fit in the sites, such pipes are made into pieces of standard length. Such cut pieces are known as connected pieces and each piece having the standard length known as maximum pipe length.

Inlet and outlet

Starting point of the pipe in which the fluid enters is called Inlet. Ending point of the pipe in which the fluid exits is called outlet. Their symbols are shown below



Isometric view **Symbol**

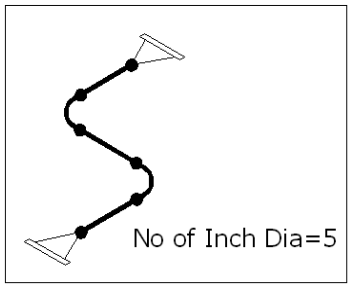
Threaded union

A union, similar to a coupling, allows the convenient future disconnection of pipes for maintenance or fixture replacement.

Inch Dia

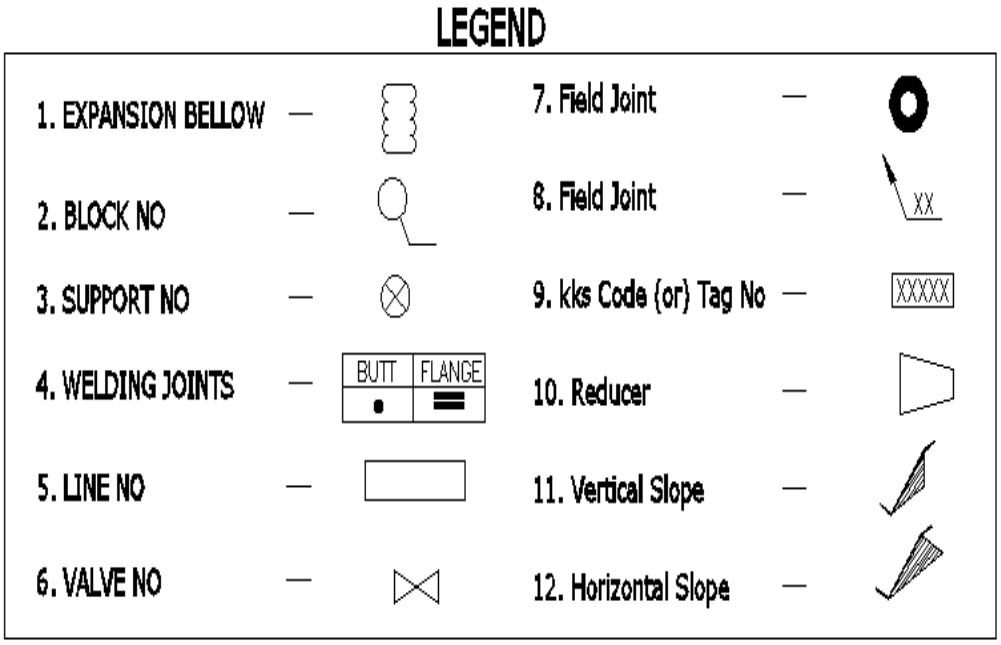
The inch dia can be calculated by the length & diameter of the pipe. This is used differently in different countries. But generally, if a welder is contracted to do say 100 weld joints, of a 1" pipe, then the total work involved is 100" dia welding work. If 100 weld joints of a 2" pipe is 200 weld work and so on.

Eg:

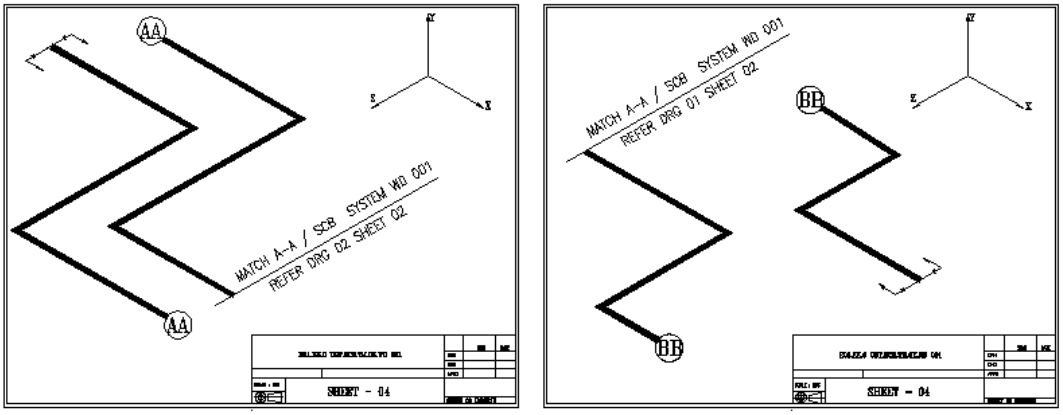


Generally in plants and industries, the pipes used varies in their sizes depending upon the processes, so as to differentiate between the pipe sizes, polyline width and colours are used in cad drawings.

Piping Legend



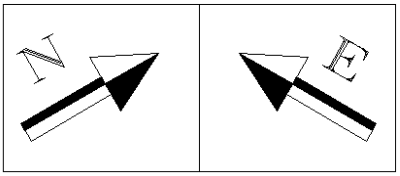
Continuation symbol



1. Match A-A/SYSTEM WD 001
   REFER DRAWING 02 SHEET 02 - the Symbol represents the continuation of one sheet to another sheet

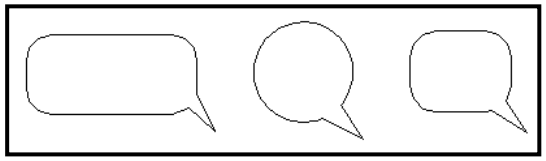
2. AA, BB, CC - the Symbol represents Continuation of the two pipelines in the sheet.

North symbol and east symbol

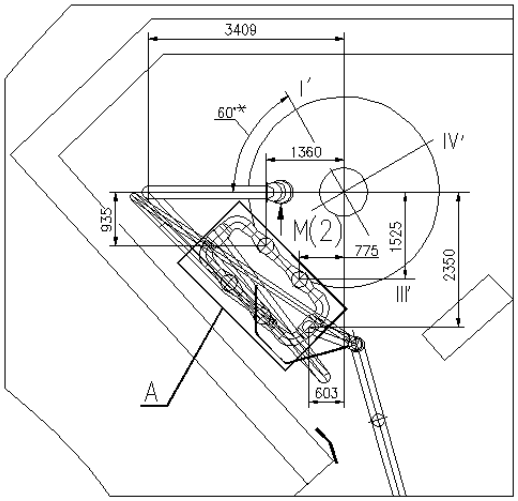


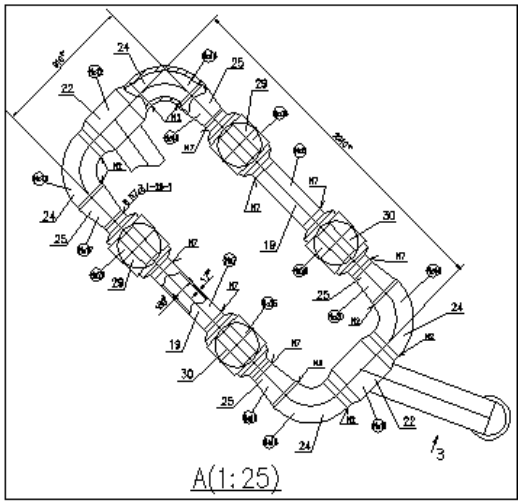
Arrrow marks are provided to indicate whether the drawing is sighted from North or East direction. These arrow marks also enable us to identify whether the routing is in clockwise or anticlockwise direction.

Detail and Detail Symbols



Example:-

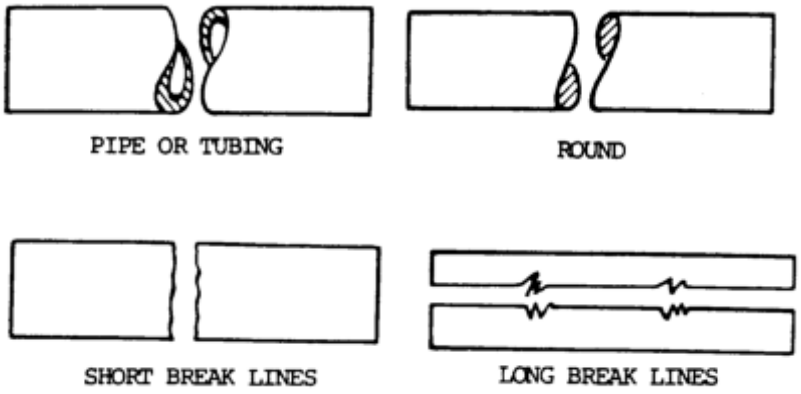




Plan

Detai

Pipe Section View and Break lines:-

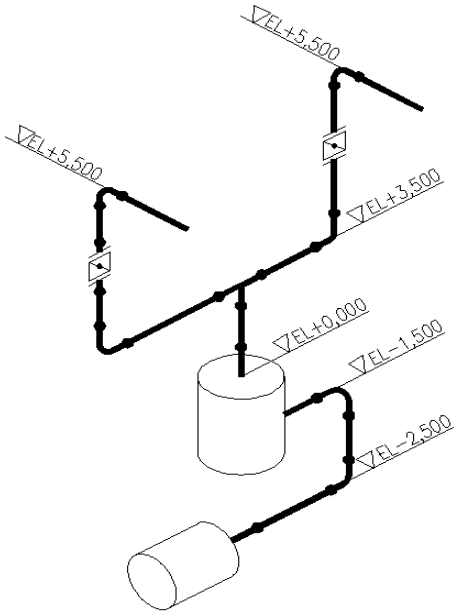


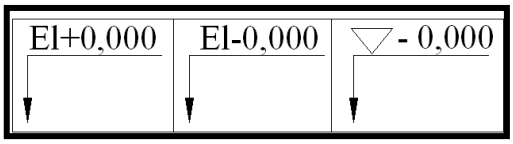
Elevation

Elevation marks shows how far the pipe is present from the base.

+ ve Sign – Above the base

- ve Sign – Below the base





Flow diagram abbreviation:-

NV	-	Needle Valve	PO	-	Pump Out
CSO	-	Car Seal Open	SO	-	Stream Out
CSC	-	Car Seal Closed	F	-	Furnished by Others
LO	-	Lock Open	DF	-	Drain Funnel
LC	-	Lock Closed			

Symbol:-

ANSI	-	American National Standards Institute
ASME	-	American Society of Mechanical Engineers
ASTM	-	American Society of Testing and Materials
BC	-	Bolt Circle
BB	-	Bolted Bonnet
BE	-	Bevelled Ends(for welding)
BF	-	Blind Flange

BM	-	Bill of Material
BOP	-	Bottom of Pipe
BW	-	Butt weld
CPLG	-	Coupling
CS	-	Carbon Steel, Cast Steel or Cold Spring
ELEV	-	Elevation
FLG.	-	Flange
FW	-	Field Weld
ID	-	Inside Diameter
IPS	-	Iron Pipe Size
LR	-	Long Radius
OD	-	Outside Diameter
OS & Y	-	Outside Screw and Yoke
RED	-	Reducer
SCH	-	Schedule
SCRD	-	Screwed
SF	-	Semi Finished
SPEC	-	Specification
SR	-	Short Radius
SS	-	Stainless Steel
STD	-	Standard
STL	-	Steel

Drafting method

1. Before beginning the piping drawing, we should have the reference drawing.
2. Current drawing should be drawn in the reference drawing by taking a copy out of it so that no new layer needs to be created.
3. Copy anyone of the piping drawings in the drawing sheet. Let us the consider that piping drawing as A. In A drawing, the TITLE BLOCK should be edited as per our requirements.
4. In the next step, piping lines should be erased in A drawing. Then we should take account of how many different pipe sizes available.
   For eg: ø87x3, ø56x2, ø32x2

   Polylines with different widths should be drawn as shown above so that it is easy to match those lines with the pipings present in our current drawing.
5. Piping routing should be drawn within the given sheet size and the above layers should be matched with the respective pipe sizes. Weld (joint), Inlet, Outlet, Dimension Style, Other Symbol can be taken and used from reference drawing.
6. Drawing should be saved for every five commands.