



# PIPING DRAWINGS BASICS

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N.P.TODKAR



There are two types of views used in the piping drawings:


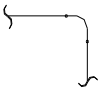

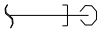
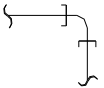


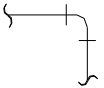


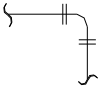

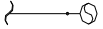
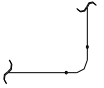

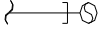
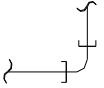

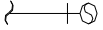
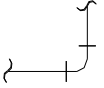

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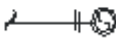


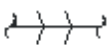
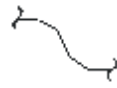

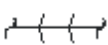
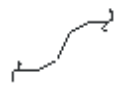

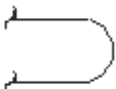
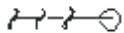

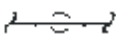
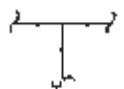

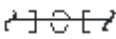
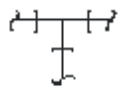

- a) Orthographic- Plans and Elevations
- b) Pictorial - Isometric Views

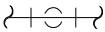
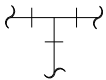


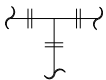

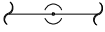
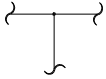

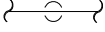
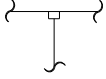

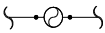
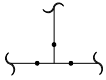

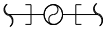
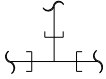


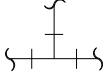

Piping layout is developed in both plan view and elevation view and section details are added for clarity wherever necessary. These drawings are called the General Arrangement of Piping.


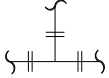

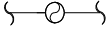
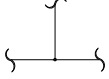

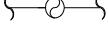
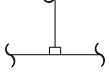


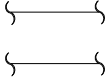

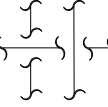
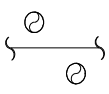

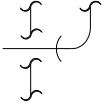
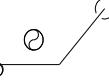

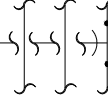
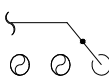

In complex piping system, especially within the unit/plant building where orthographic views do not illustrate the details of design, pictorial view in isometric presentation is drawn for clarity.

## PIPING SYMBOLS

Sr. No.	DESCRIPTION	PLAN	END VIEW 1	END VIEW 2
1.0	CHANGE OF DIRECTION AT 90°			
1.1	DOWNWARD BENDING			
1.1.1	BW elbow			
1.1.2	SW elbow			
1.1.3	Scrd elbow			
1.1.4	Flgd elbow			
1.1	UPWARD BENDING			
1.2.1	BW elbow			
1.2.2	SW elbow			
1.2.3	Scrd elbow			

Sr. No.	DESCRIPTION	PLAN	END VIEW 1	END VIEW 2
1.0	CHANGE OF DIRECTION AT 90°			
1.2	UPWARD BENDING			
1.2.1	Rigid elbow			
2.0	CHANGE OF DIRECTION AT OTHER ANGLES			
2.1	DOWNWARD BENDING			
2.2	UPWARD BENDING			
2.3	180° Returns			
3.0	BRANCHING			
3.1	DOWNWARD			
3.1.1	BW Tee			
3.1.2	SW Tee			

Sr. No.	DESCRIPTION	PLAN	END VIEW 1	END VIEW 2
3.0	BRANCHING			
3.1	DOWNWARD			
3.1.3	Scrd Tee			
3.1.4	Flgd Tee			
3.1.5	Stub connection			
3.1.6	Half Coupling			
3.2	UPWARD			
3.2.1	BW Tee			
3.2.2	SW Tee			
3.2.3	Scrd Tee			

Sr. No.	DESCRIPTION	PLAN	END VIEW 1	END VIEW 2
3.0	BRANCHING			
3.2	UPWARD			
3.2.4	Flgd Tee			
3.2.5	Stub connection			
3.2.6	Half Coupling			
4.0	PARALLEL LINES			
5.0	CROSS LINES			
6.0	ROLLED ELBOW			
7.0	ROLLED TEE			

Sr. No.	DESCRIPTION	PLAN	END VIEW 1	END VIEW 2
8.0	VALVES			
8.1	Hand Wheel Operated Flgd Valve with vertical hand wheel			
8.2	Lever operated Valve			
8.3	Hand wheel operated BW Valve with rolled hand wheel			
9.0	CONCENTRIC REDUCER	$a \times b$ 		
10	ECCENTRIC REDUCER			

FSU/ FSD



The Indian Standard IS10711 standardises the drawing sheets as below:

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**SIZE**

**OVERALL  
DIMENSIONS in mm**

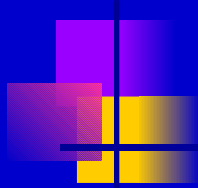
A0	-	841 x 1189
A1	-	594 x 841
A2	-	420 x 594
A3	-	297 x 420
A4	-	210 x 297



## HOW TO START THE PIPING GA?

- Obtain the drawings numbers and fill in the title block, with the drawing number and title at the bottom right hand corner of the sheet.
- Place the north arrow at the top left/right hand corner of the sheet to indicate plant north.
- Do not plan drawing in the area above the title block of drawing, as this is allotted for general notes, number and title of reference drawings, brief description of changes during revision and the bill of materials wherever applicable. 
- Process equipment and piping have priority on the Piping GA.
- The piping drawings are started after fixing positions of the equipments.
- Equipment layout is reproduced on the Piping GA to its scale and drawn on the reverse side in case of manual drafting.

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- In case of CAD separate layer is used. The major primary beams and secondary beams are also shown if area covered is indoor.
- Pertinent background details which govern piping routing, such as floor drains, HVAC ducting, electrical and instrument cable trays, etc. are also drawn in faint on the reverse.
- Utility stations are also established so that most convenient utility header routing can be carried out.



MATCHLINE AREA - 1

MATCHLINE AREA - 4

MATCHLINE AREA - 2

GENERAL NOTES :

REFERENCE DRAWINGS :

1	2
3	5
4	

KEY PAN

REVISIONS

SR.NO	REV	DESCRIPTION	DATE	APPROVED
DRG.NO.	REV.	COMPANY NAME		
DRAWN BY PIPING CELL		PROJECT :		
CHKD BY PIPING CELL		TITLE : G.A.DRAWING OF PIPING CELL		
APPD BY PIPING CELL		SHEET 1 OF 1		

8

7

6

5

4

3

2

1



## Order of importance/preference of pipe lines in a piping GA

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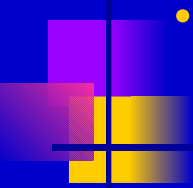
1. Alloy steel/special material of construction.
2. Large bore piping
3. High temp/high pr. Piping
4. Lined piping
5. C. S. Process Piping
6. Utility piping

## DEVELOPMENT OF PIPING GENERAL ARRANGEMENT DRAWING

- The piping drawings should be developed in such a way that
  - all the process requirements are met with.
- It is not always possible for the piping drawing to follow exactly the logical arrangement of the P & IDs. Sometimes lines must be routed with different junction sequence and line numbers and subsequently the list may be changed.
- Performance and economics have to be considered in parallel while deciding the routing.
- Piping is represented by single lines up to a size of 150NB

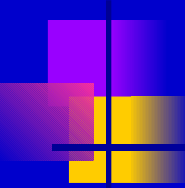
and double lines for sizes 200NB and above. This is to save the time of drafting and to avoid confusion.

- In single line representation only the center line of the pipeline is drawn using solid line and in double line representation the actual size to scale is drawn with center line marked in chain-dotted lines

- 
- Line numbers are shown against each line exactly in the same way as represented in the P&I diagrams.
  - The change in specification should be shown in line with P&I diagram. This change is usually indicated immediately to the downstream of the valve, flange or equipment.
  - Valves should be drawn to scale with identification number from the P&ID marked thereon.
  - Draw valve hand wheels to scale with stem fully extended.

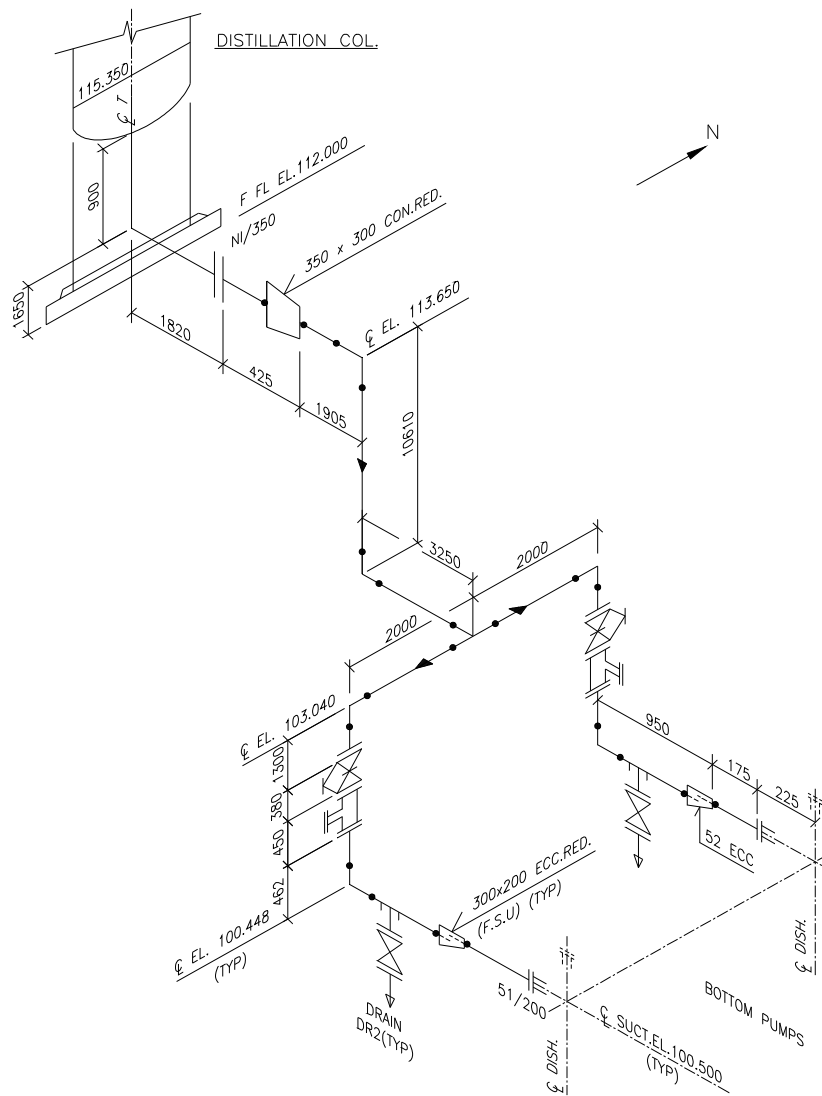
If it is lever operated, then the movement of handle position should be marked.

- If a valve is chain operated, note the distance of the chain from the operating floor.
- Show location of each instrument connection with encircled instrument number taken from P&ID.
- Similar arrangement shall be shown as typical detail or covered in a separate company standard as Instrument Hook-up drawings.


- 
- Draw plan view of each floor of the plant and these views should indicate how the layout will look like between floors as seen from top.
  - Each line should be identified by line number and should also show the insulation, tracing requirements, etc.
  - Lines, if required, shall be broken to show the required details of hidden lines without drawing other views.
  - Do not draw details that can be covered by a note.
  - Draw plan to a larger scale for any part needing more details and identify it as “Detail ‘A’”, etc.
  - Draw part isometrics sketches or part elevations to clarify complex piping or piping hidden in the plan view.
  - Full sections through the plant may be avoided if isometric drawings are drawn for the lines. Part sections where required shall be shown to clear the hidden details in plan.
  - Sections in the plan views are identified by numbers say 1-1, 2-2, etc. and details by alphabets, e.g. “Detail ‘A’”.

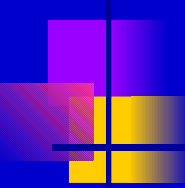


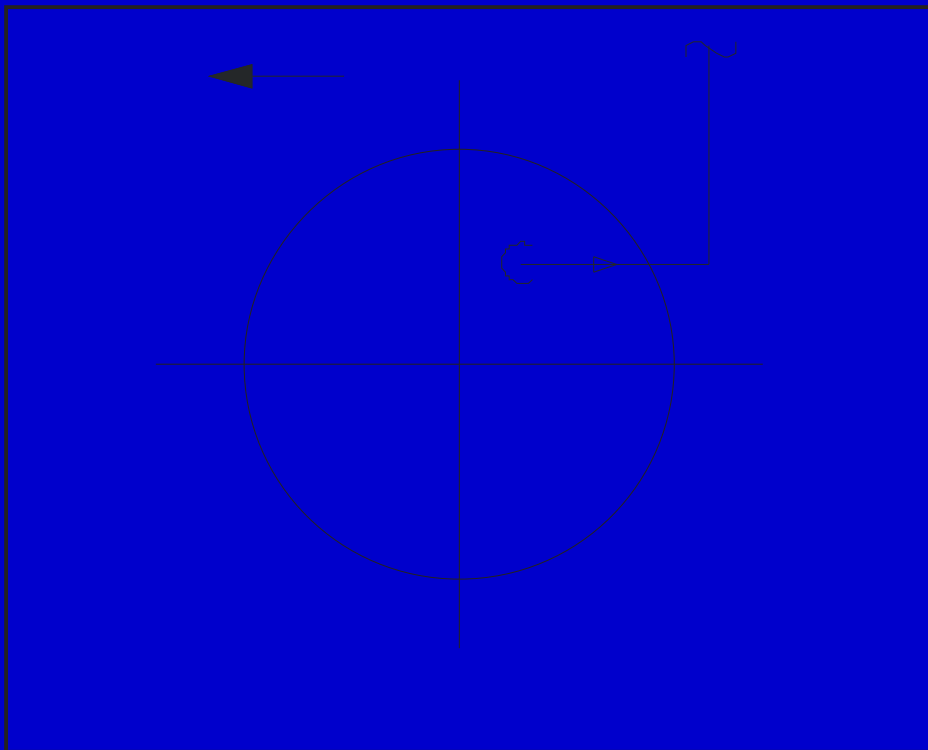
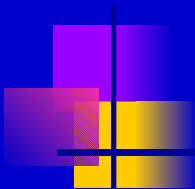


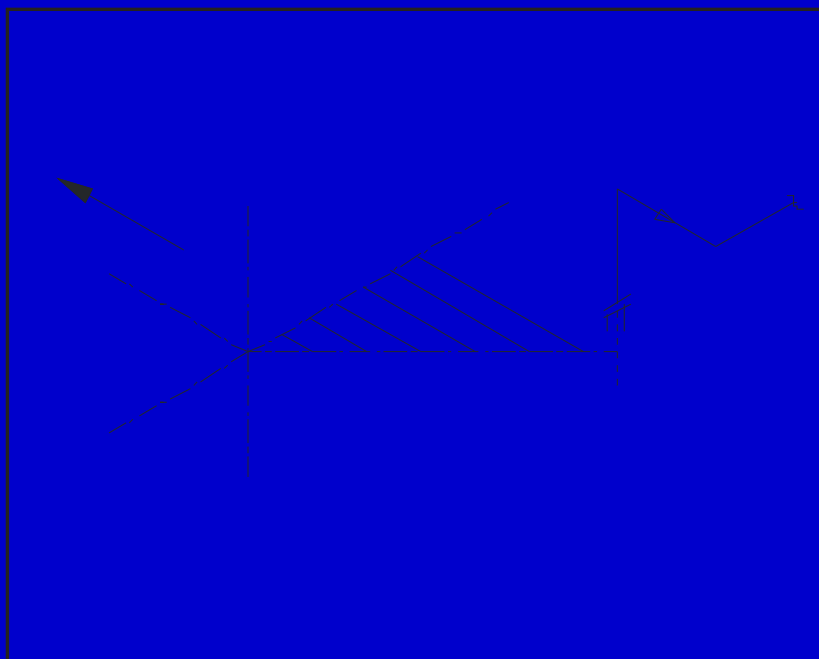
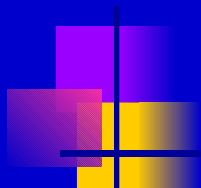


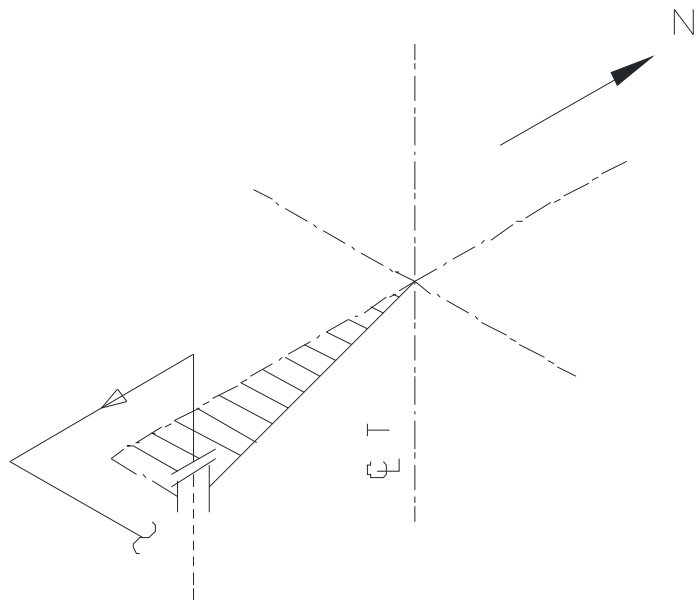
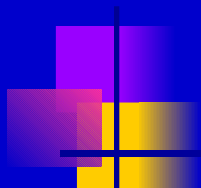
- 
- Plant North - The direction should be so selected as to facilitate easy checking of GA with Iso 

- Isometric drawing should also include the following information: 
  - Dimensions and angles.
  - Reference number of P & IDs, GA Drawings, line numbers, direction of flow, insulation and tracing.
  - Equipment location and equipment identification.
  - Give nozzle identification on the connected equipment.
  - Give the details of flange on the equipment if the specification is different from the connecting piping.
  - Size and type of every valve/ Direction of operation.
  - Size and number of control valve.
  - Location, orientation and number of each equipment.

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- Field weld - preferred in all directions to take care of site variations. Can also be covered with a general note.
  - Location of high point vents and low point drains. Covered with a standard arrangement note.
  - Bill of Material.
  - Requirements of stress relieving, seal welding, pickling, coating, etc.

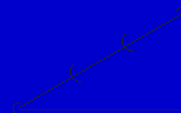
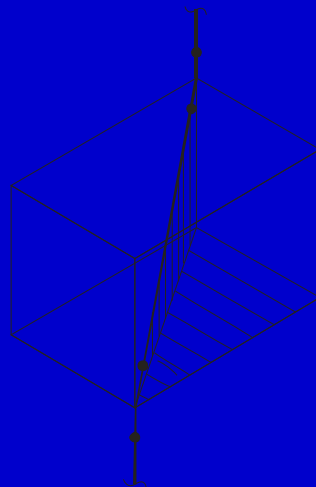
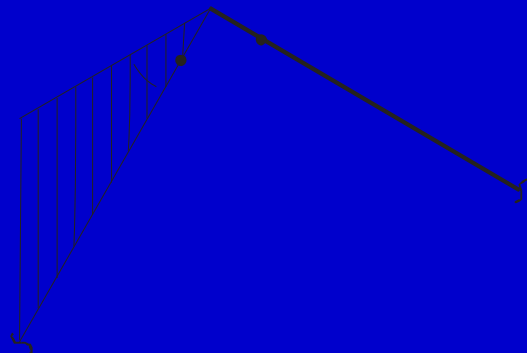
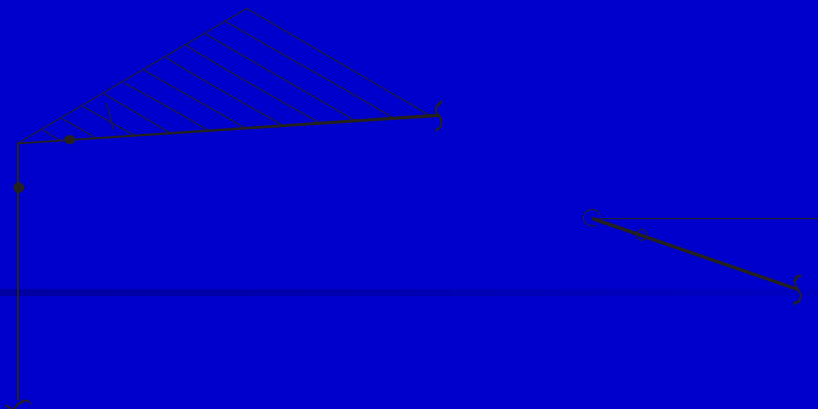
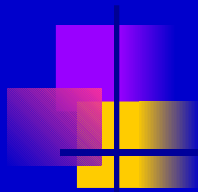






IMPROPER NORTH ORIENTATION







## SPOOLS

A spool is an assembly of fittings, flanges and pipes that may be prefabricated. It does not include bolts, gaskets, valves or instruments. A spool sheet is an orthographic drawing of a spool drawn either from piping GA or from an iso sheet. Each spool sheet shows only one type of spool and,

- Instructs welder to fabricate the spool
- Lists the cut lengths of pipe, fittings and flanges etc. needed to make the spool
- Gives material of construction and any special treatment of finished piping
- Indicates how many spools of the same type are required

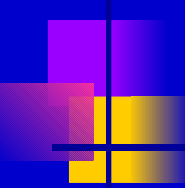


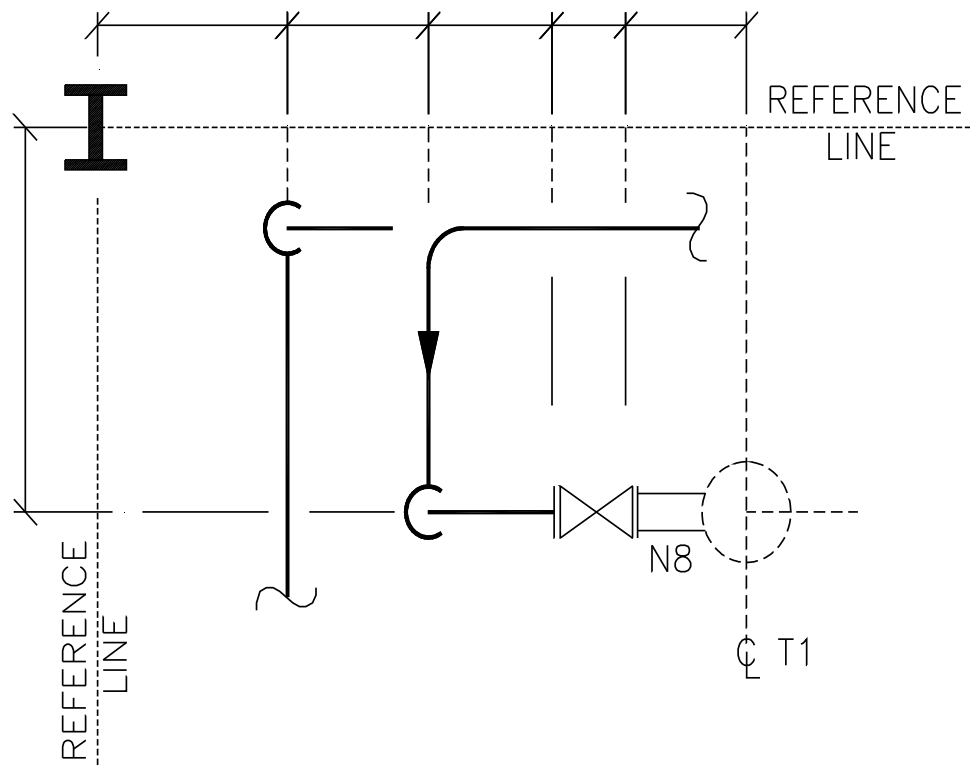
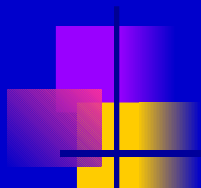


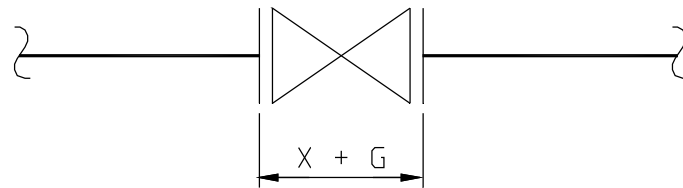
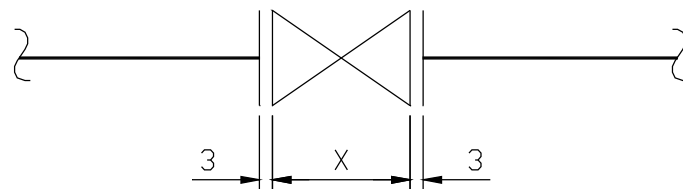
## **DIMENSIONING OF DRAWINGS**

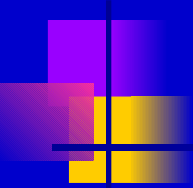


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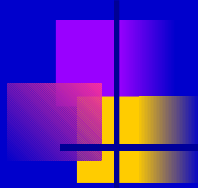
- Sufficient dimensions to be given for positioning equipment and for erecting piping.
- Duplicating dimensions in different views should be avoided, as this may lead to errors if changes are made.
- Reserve horizontal dimensions for the plan view.
- If single pipe is to be positioned or a pipe connected to nozzle is to be indicated, then show the centre line elevation and mark as C .
- If several pipes are sharing a common support, show elevation of Bottom of Pipes and mark as BOP EL. This is more applicable to non-insulated lines.

- 
- In case of several pipes on a pipe rack, show the “Top of Support” elevation and mark as TOS EL.
  - In case of buried pipelines in trench, show elevation of bottom of pipes.
  - In case of drains and sewers, the Invert Elevation of the inside of the pipe is marked as IE.

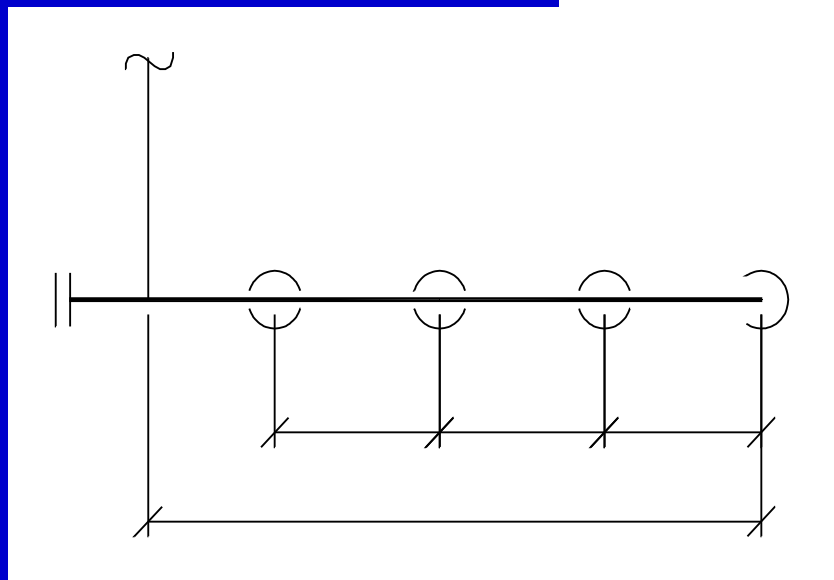
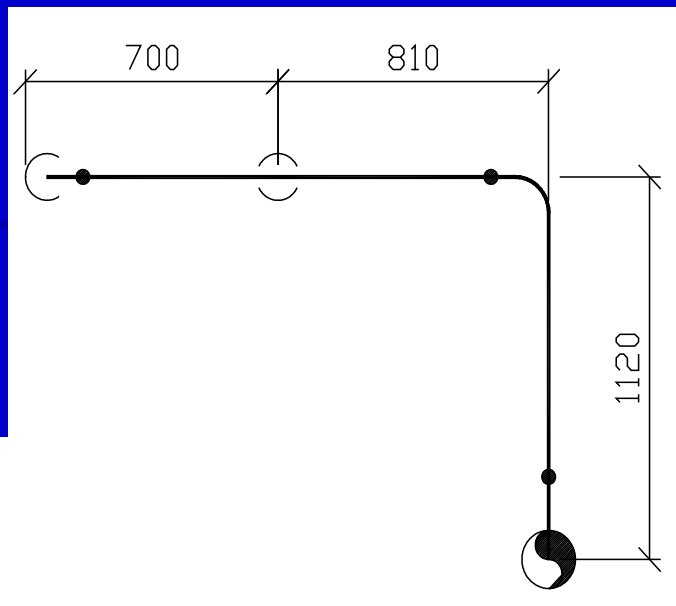
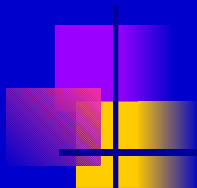







- 
- Centre lines of the equipment and pipelines shall be  located with reference to the building column centre lines or the co-ordinates which can be considered as a reference base.
  - The distance between the lines shall be dimensioned centre line to centre line.
  - The horizontal nozzles on the equipment shall be located from centre to flange face in plan.  For vertical nozzles show Face of Flange elevation (FOF).
  - For valves, instruments and non-standard equipments, show the dimensions from flange face to flange face.

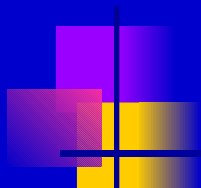


- Flanged valves are located with dimension to flange faces. Non-flanged valves are dimensioned to their centres or stems.
- For flanged joints show a small gap between dimension lines to indicate gasket. Flanged joints can also be shown without gasket but cover the same with a general note and include gasket thickness in the valve or equipment dimensions.
- For Finished Floor (FF) the elevation shall be the high point of the floor.

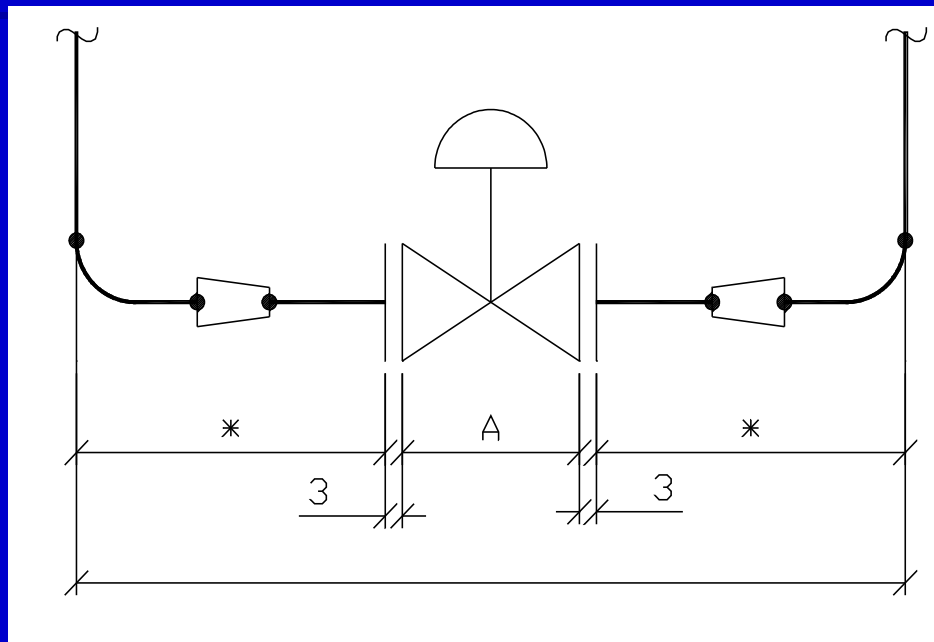
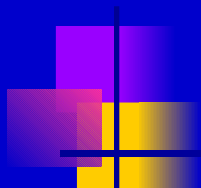


- For foundation the Top of Grout (TOG) elevation is shown.
- Show dimensions outside the drawn view - do not cut pictures. 
- Draw dimension line unbroken with fine line. Write dimension just above the horizontal line. For vertical lines write sideways.
- The dimension lines can be terminated with arrow heads or oblique dashes.  
- If series of dimension is to be shown, string them together.
- Show overall dimension of the string of dimensions. Avoid one of the break-up dimensions to omit repetition and error during changes.
- Do not omit significant dimension other than fitting make up.





- For field run piping, give only those dimensions which are necessary to route piping clear of equipments and other obstructions. Locate only those items which are important to the process.
- Underline out of scale dimensions or mark as NTS.
- Do not terminate dimensions at screwed or welded joints.





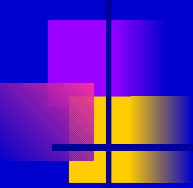
## CHECKING OF PIPING DRAWINGS

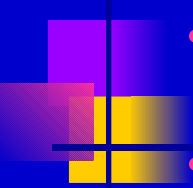
Checking shall be done only on the print or the check plot of the drawings and by coloured pencils/pens.

- A. Corrected areas and dimensions are marked yellow.
- B. Areas and dimensions which are to be deleted are marked green.
- C. Areas to be corrected/incorporated on the drawing are marked in red.

The new print after correction is “back checked” for incorporation.

Points to be checked on the piping drawing includes:  
Title of the drawing.

- 
- **Title of the drawing.**
  - **Orientation - North arrow against plot plan.**
  - **Inclusion of graphic scale (if drawings is to be reduced).**
  - **Co-ordinates of equipments against equipment layout.**
  - **Equipment numbers and their appearance on the piping drawing.**
  - **Correct identification on all lines in all views.**
  - **Line specification changes.**
  - **Reference drawing numbers and files.**
  - **Correctness of all dimensions.**
  - **Whether representation is correctly made in line with the standard symbols or not.**
  - **Location and identification of all instruments.**
  - **Requirements of upstream/downstream straight lengths.**
  - **Insulation requirements as per P&IDs.**
  - **Piping arrangement against P&ID requirements such as gravity flow, seals, etc.**
  - **Possible interference**
  - **Floor and wall openings.**

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- Correctness of scale in case of General Arrangement Drawings
  - Whether all stress analysis requirements are met or not
  - Adequacy of clearance from civil structures, electrical apparatus and instrument consoles.
  - Accessibility of operation and maintenance space and provision of drop out and handling areas.
  - Foundation drawings and vendor equipment requirements
  - Details and section identification match.
  - “Matchline” provision and accuracy.
  - Presence of signatures and dates.
  - Accuracy of BOM in Isometrics.
  - Number of issues and revision.

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