International Journal of Scientific Engineering and Technology ISSN : 2277-1581
Volume No. 7, Issue No. 2, PP : 13-16 1 Feb. 2018

Basics of Piping

Abhishek Sharma, Ankush Thakur
Piping Engineer, CINDA Engineering & Construction Pvt. Ltd., Noida

ABSTRACT – Piping system plays a vital role in Power plants, Petroleum refineries, Food processing unit, Chemical Plant, Textile plants etc. Through piping system has huge number of component installed in it but there is some major components. This research paper deals with the basic understanding of piping ,its main component, piping standards, Documents required in piping. In this paper we try to mention brief description of all aspects of piping, through it seems to be a quite simple but practically this research paper is of great importance for Piping engineer, Students and Teachers.

KEYWORDS :Piping system, Components, Standards.

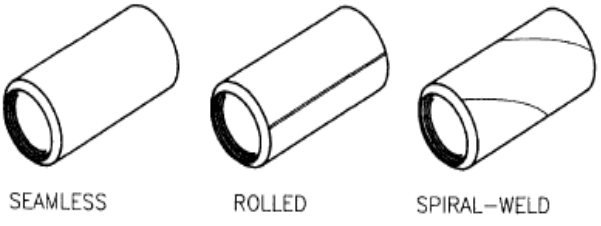
INTRODUCTION

From starting of industrialization piping system has been playing major role because of its great importance and low cost to conveying fluid as per requirement and uses. Due to this high importance it has been widely using in Power plants, Chemical plants, Textile plants, Refineries etc. Piping is the heart of refineries, due to this great importance industrialist fixed some standard and code for piping and its material. There are some particular set of documents required to represent piping system like GA drawing, PMS(Piping material specification), Line drawing, P & ID(Piping and instrumentation diagram) etc.

PIPING AND ITS COMPONENTS

Piping contains many components but some major components are pipe, fitting, flanges, valves, gasket & bolting. We will discuss in brief about each one of above-

PIPE : Pipe is a hollow, cylindrical body used to transport any commodity possessing flow characteristics such as those found in liquids, gases, vapors, liquefied solids, and fine powders.
There is list of material which can be used to manufacture pipe. Some of material are Plastics, Cast iron, Cast steel, Stainless steel, Aluminum, lead, brass, glass and alloy steel. It is a wise choice to choose material of pipe according to application.
Carbon steel pipe can be manufactured using several different techniques, each of which produce pipe of different characteristics. The manufacture methods widely use are seamless, butt welded and spiral welded pipe.
Nominal pipe size (NPS) is a dimensionless designator of pipe size. It indicates nominal pipe size followed by an inch symbol.
For example NPS 2 represent Nominal pipe size of 2.375 inch. The NPS 12 and smaller has outside diameter greater than size designator (say 2,4,6). However NPS 14 and above has outside diameter equal to the designator in inches. The term schedule was invented to represent pipe wall thickness. Schedule is expressed in numbers (5, 5S, 10, 10S, 20, 20S, 30, 40, 40S, 60, 80, 80S, 100, 120, 140, 160). The higher the schedule number, the thicker the pipe is.

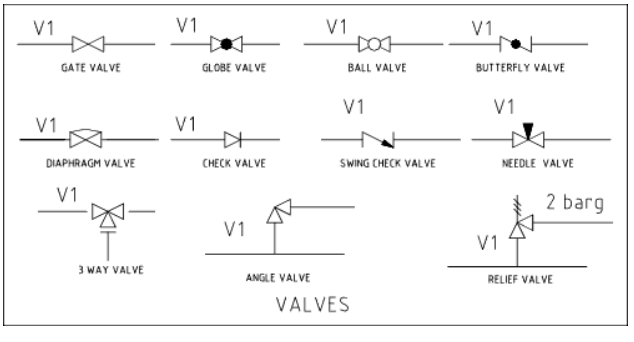


{Fig-1:Type of pipe}

VALVES : Valve is very essential part of any piping system. It is primarily use to stopping, allowing or diverting fluid flow. Each valve has different design and categories, each offering different features and functional capabilities. Some valves are self-actuated and some manually operated. Valves also assist in to maintaining pressure and temperature of the flow medium within desired range or limit. In order to select a valve for a particular application, one must evaluate its characteristics including design features, material of construction, piping design criteria and economical factor. Some of main types of valves are-

- **Gate Valve**
- **Globe Valve**
- **Check Valve or Non return valve**
- **Ball Valve**
- **Relief Valve**
- **Butterfly Valve**
- **Control valve**

Each valve represent by a specific symbol. In Fig-2 valve



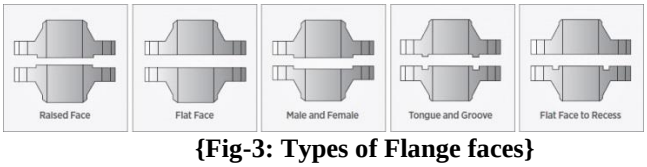
{Fig-2: Valve symbols}

and its Symbols are shown.

International Journal of Scientific Engineering and Technology ISSN : 2277-1581
Volume No. 7, Issue No. 2, PP : 13-16 1 Feb. 2018

FLANGE : Flange is a ring shaped device used as an alternative to welding or threaded connection because it can be easily assembled or disassembled. It is primarily use where connection or dismantling joints are required such as pipe to fittings, valves, equipment etc.
Flanges are sized according to pressure rating established by ANSI. Rating may be best defined by maximum pressure allowed by the pressure piping for specific temperature.
The mating surface of flange is called face. This smooth surface will help assure a leak proof seal when two flanges are bolted. Main three types of faces are-

- Flat face
- Raised face
- Ring type joint



{Fig-3: Types of Flange faces}

Flanges have been designed and developed to be used in a myriad of applications. Each one has its own special characteristics, and should be carefully selected to meet specific function requirements. Some of main types of flanges are-

- **Weld neck**
- **Threaded**
- **Socket weld**
- **Slip-on**
- **Lap-joint**
- **Blind**
- **Orifice**

FITTINGS : Fittings are fabricated peace of pipe which are used to make changes of direction (Elbow), branch from main pipe (Tee), Reducing pipe size(Reducer). Fittings are the part of the piping system, they must match as closely as possible in specification to which they are being attached. Fittings like elbow are manufactured and classified according to wall thickness. Fittings are generally manufactured in standard weight, extra strong, schedule 160 and double extra strong. Main type of fittings are-

- **Elbow**
- **Tee**
- **Stub in/Stub on**
- **Reducer**
- **Coupling**
- **Cross**
- **Union**
- **Nipple**
- **Return**
- **End cap**

{Fig-4: Piping Fittings}

CODES AND SPECIFICATION : Codes are the broad set of guideline which govern the total scope of a project. They are originated from a number of sources. Some sources are government agencies such as OSHA, EPA or some are organization such as ANSI, ASME, ASTM, API etc. Codes have been developed for regulation of pressure and temperature limit, workers safety, material composition and stresses, emergency evacuation process and many more. Table provide the list of partial codes written for piping facilities-

- ASME B31.1 - Power Piping
- ASME B31.3 - Process Piping
- ASME B1.1 - Unified Inch Screw threads
- ASME B1.20.1 - Pipe Threads, General Purpose (Inch)
- ASME B16.5 - Piping Flanges and Flanged Fittings
- ASME B16.9-Factory-Made Wrought Steel Butt welding Fittings
- ASME B16.10 - Face-to-Face and End-to-End dimensions of Valves
- ASME B16.11 - Forged Fittings, Socket-Welding and Threaded
- ASME B16.20 - Metallic Gaskets for Pipe Flanges-Ring Joint, Spiral Wounds and Jacketed
- ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges
- ASME B16.25 – Butt welding Ends
- ASME B16.34 - Valves-Flanged, Threaded, and Welding End
- ASME B16.47 - Large Diameter Steel Flanges, NPS 26 through NPS 60
- ASME B16.48 -Line Blanks
- ASME B18.2.1 - Square and Hex Bolts and Screws (Inch Series)
- ASME B18.2.2 - Square and Hex Nuts (Inch Series)
- ASME B36.10 - Welded and Seamless Wrought Steel Pipe
- ASME B36.19 - Stainless Steel Pipe
- ASME B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay)

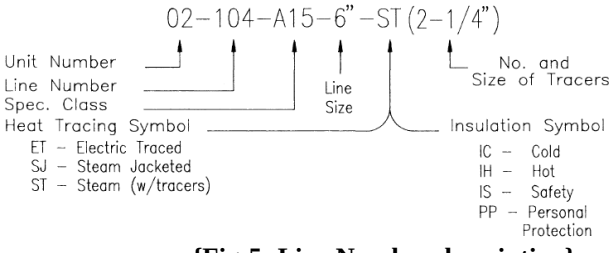
Specifications, on the other hand, are developed as a specific set of guidelines for design, fabrication, and construction of a

International Journal of Scientific Engineering and Technology
Volume No. 7, Issue No. 2, PP : 13-16
ISSN : 2277-1581
1 Feb. 2018

piping facility. Written to maintain consistency and uniformity throughout all phases of a project, *specs* are very detailed. Codes can be as broad as statements indicating that all facilities must be built in accordance with ANSI standards, while specs are so detailed they can include instructions to a painter indicating which pipe to paint red.

As we look at codes and specs, remember that they have been developed through years of trial and error. When something purchased didn't fit, something built broke, or something boiled blew up, someone made a note of the mistake, remembered it the next time a similar situation occurred, and made it an operational procedure. The operational procedure evolved into a piping code.

As an example to how specification applied to piping drawing is represented below-



{Fig-5: Line Number description}

Specification are divided into classis developed for particular service. Classes are categorized by the commodity within pipe. Figure provided a index of classes of specification.

Specification Classes

Class	Flange Size & Rating	Material	Commodity Service
A15	150# RFWN	C.S.	HYDROCARBON PROCESS
C30	300# RFWN	C.S.	HYDROCARBON PROCESS
IA15	150# RFWN	GALV.	INSTRUMENT AIR
PA15	150# RFWN	C.S.	PLANT AIR
S15	150# RFWN	C.S.	LP. STEAM
W15	150# RFWN	C.S.	SERVICE WATER

PIPE A15 SPEC

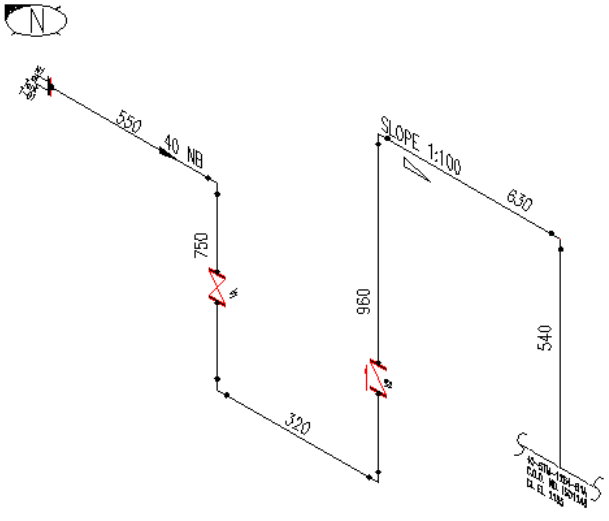
POUND RATING 150#			MATERIAL: CARBON STEEL	
CORROSION ALLOWANCE .05"	CONDITIONS: PSIG / °F		DESIGN: 200 / 350	OPERATING: 175 / 275
ITEM	SIZES IN INCHES	WEIGHT/ RATING	DESCRIPTION	
Pipe	1/2"–11/2" / 2" / 3"–24"	EX. HVY. / STD. WT. / STD. WT.	SEAMLESS-PLAIN ENDS / SEAMLESS-PLAIN ENDS / SEAMLESS-BEVELED ENDS	
Fittings	1/2"– 2" / 3"–24"	3000# / STD. WT.	FORGED STEEL SOCKET WELD / FORGED STEEL BUTT WELD	
Flanges	1/2"–11/2" / 2" / 3"–24"	150# / 150# / 150#	FS - RAISED FACE SOCKET WELD / FS - RAISED FACE SOCKET WELD / FS - RAISED FACE WELD NECK	
VALVES	SIZES IN INCHES	WEIGHT/ RATING	DESCRIPTION	Man./Model No. / END TYPES
Gate	1/2"– 2" / 3"–24"	150–800 / 150	CAST STEEL / CAST STEEL	CRANE: Model No. 46XU / CRANE: Model No. 47XU — SCRD / RF
Globe	1/2"– 2" / 3"–24"	150–800 / 150	CAST STEEL / CAST STEEL	CRANE: Model No. 142X / CRANE: Model No. 143X — SCRD / RF
GASKETS	Flexitallic style - 150#, 304SS: 1/8" thick			
BRANCH CONNECT.	LINE SIZE: 2"-BELOW, 3"-ABOVE	USE A TEE / USE A TEE AND SWAGE ON SIZES 2" & SMALLER / STUB-IN WHEN LESS THAN LINE SIZE		150#

• **DESIGNING SOFTWARE –** There are many different CAD software used for piping design. Industry adopt different software according to their convenience, client demands etc. One should have a basic understanding and an overall view of all widely use software. Developers develop, refine and revise software as to meet the demand of engineering and designing firm. Software like Auto cad and micro station are basics of all designing. While some of main software package for piping are AUTOPLANT, Smart plant 3D, PDS and PDMS.

{Fig-6: Designing software}

DOCUMENTS USED IN PIPING – Piping contains a large number of documents to represent itself. There are several types of standards, Standard documents and drawings associated with different models. Main types of documents used are-

- Layout
- Process flow diagram (PFD)
- Piping and Instrumentation drawing (P and ID)
- Equipment Data sheet
- GA drawing
- Isometric drawing
- Piping material specification (PMS)



{Fig-7: Piping Isometric drawing}

Layout majorly of four types Overall layout, area index, unit plot plan, Section. These give the overall idea of plant. The PFD is use to indicate the general flow of plant process and flow diagram. P and ID is a diagram which represent the interrelation between Process equipment and the instrument use to control the process. Equipment data sheet is a document which summarize the product technical specification. Piping isometrics allow the pipe to be drawn in a manner by which the length, width and depth are shown in a single view. Isometrics are usually drawn from information found on a plan and elevation views. Piping material specification is a document which is provided by client or some standard organization, it contains all details of piping.

CONCLUSION

The piping system, its components, codes and specification is described above.

Though one can see this paper very basic but this contain an overall idea of piping. We try to introduce maximum aspect of piping in this paper. Also it is shown that how codes and specification plays an important role in piping. Piping designing software is also explained and shown that how we need to advance designing software with demand of modern engineering and client expectation. In the modern era we need our software to deliver precise details with maximum speed. This paper summarizes documents which are required for piping and also explained what type of information we get from a particular document. This paper can be useful for piping student, Teacher or Trainee piping engineer. One can be familiar with all terms of piping and its related terms.

ACKNOWLEDGEMENT

The author hereby thank the authors of the below mention references for their valuable contribution which enable us to analyze and putting our view in this system.

REFERENCE

i. *http://petrowiki.org/Pipeline_design_consideration_and_standards*
ii. *http://www.klmtechgroup.com/PDF/ess/PROJECT_STANDARDS_AND_SPECIFICATIONS_piping_materials_Rev01web.pdf*
iii. *Piping Drafting and Designing by Roy A. Parisher and Robert A. Rhea.*
iv. *Piping and Pipeline Engineering by George A. Antaki*
v. *https://en.wikipedia.org/wiki/Piping*
vi. *http://catalog.asme.org/Codes/PrintBook/B311_2004_Power_Piping.cfm*
vii. *Payal Sharma, Mohit Tiwari and Kamal sharma, Design and Analysis of a process Plant piping system, Issue 3, ISSN 2277-4106, International journal of current Engineering and Technology.*
viii. *http://www.os.is/gogn/unu-gtp-sc/UNU-GTP-SC-12-36.pdf*
ix. *Piping Handbook by Mohinder L. Nayyar*
x. *https://en.wikipedia.org/wiki/Process_flow_diagram*