Process Piping - Joints, Fittings and Valves

An Online Continuing Education Course for Engineers

Course Number: M-4043

Credit: 4 Hours / 4 PDH / 4 CPD

Process Piping – Joints, Fittings and Valves

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A piping system has a lot of components such as fittings, flanges, gaskets, bolts, valves and various special items. Although they make look simple, these elements are critical to piping integrity and plant safety.

There are specific code requirements that describe the dimensional tolerances, materials, and pressure rating of the piping components; they also determine when it is permissible to use threads or when welding must be used for joint connections.

This 4-hour course explains piping joints, fittings, offsets, flanges, gaskets, and accessories as well as where to apply these per industry practices. References to relevant ASME codes and their proper service applications in pressure piping applications are also provided.

This course is module 4 of 9 in a series that covers the entire gamut of piping engineering in an easy-to-learn format. All topics are introduced to readers with no or limited background on the subject.

This module 4 is divided in three (3) chapters:

CHAPTER -1: JOINTS AND FITTINGS

The chapter describes various types of pipe joints (weld, socket, thread, flanged), fittings (bends, elbow, tees, reducers, stub ends, couplings, cross, cap, plug and nipples), special pipe olets (weldolets, sockolets, threadolets, elbowlets, latrolets), expansion joints, strainers and traps. It discusses the criteria for selection and provides reference to the relevant ASME codes. Standard symbols and abbreviations are also shown.

CHAPTER – 2: FLANGES, GASKETS & BOLTS

This chapter covers flanges, gaskets and bolts. It discusses the pressure rating concept for flanges and types of flanges including weld neck, slip-on type, socket weld, reducing flange, lap joint, blind flange and orifice flanges. The selection

recommendation for flat face, raised face and ring type flange is discussed. Selection criteria for different types of gaskets, bolts and fasteners, their standards, and the advantages and limitations of each are provided. Reference of relevant ASME codes and their proper service applications in pressure piping applications is provided.

CHAPTER – 3: VALVES

This chapter describes the various types of valves and their applications. The characteristics, ratings, advantages and disadvantages of the most commonly-used valves such as gate valve, ball valve, globe valve, butterfly valve, check valve, diaphragm valve and various safety relief valves are provided. The material of construction and the selection criteria is covered. Reference of relevant ASME codes and their proper service applications in pressure piping applications is provided.

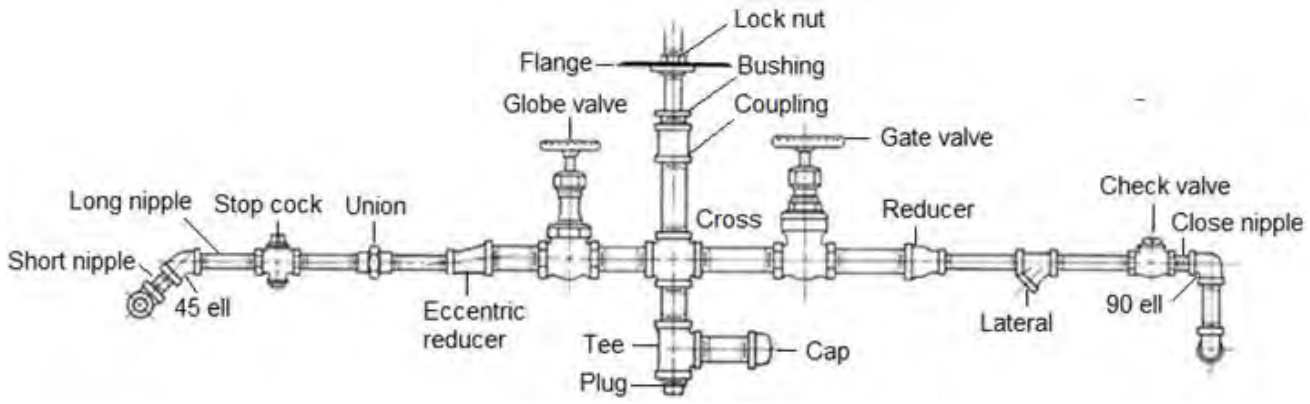
CHAPTER 1

1. JOINTS AND FITTINGS

Pipework is made up of many fittings and components.

In general, all the accessories applied to a pipeline system are collectively known as pipe fittings. Nevertheless, we often refer to elbows, tees, reducers, caps and other varied joints as pipe fittings. At the same time, products like flanges, gaskets, valves, strainers, expansion joints, supports, etc. are not listed in the same category and are normally categorized as components. Depending on the purposes served, pipe fittings can be categorized as:

- **Fittings to change pipe's direction:** for example, elbows
- **Fittings to change pipe size:** for example, reducers, bushings, couplings
- **Fittings to extend or terminate pipe runs:** for example, couplings, adapters, unions, caps and plugs pipe.
- **Fittings to connect two or more pipes:** for example: tees, cross, side-inlet elbows, wyes
- **Fittings to manage or regulate flow:** for example, valves
- **Fitting tools:** for example, pipe fasteners
- **Fittings to connect valves and equipment:** For example, flanges



Fittings for pipe are mostly made from the same base material as the pipe. However, any material allowed by code may be used, but it must be compatible with the other materials in the system, the fluids being transported, and the temperatures and pressures inside and outside of the system. Fittings can be quite expensive and require a considerably large labor element to install; therefore, correct selection and use is of vital importance.

Method of connection can be: butt weld, weld socket, and threaded.

1.1. STANDARDS

ASME Standard B16.9 covers overall dimensions, tolerances, ratings, testing, and markings for factory-made wrought butt welding fittings in size NPS 1⁄2 through NPS 48 (DN 15 through DN 1200).

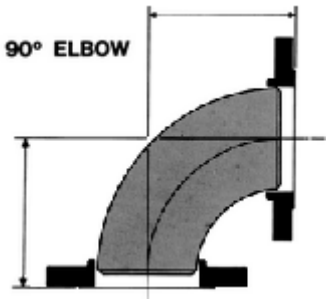
Forged steel fitting, socket welding fittings and threaded fittings are covered by ASME B16.11.

1.2. TYPES

1.2.1. Elbows/Bends

An elbow (abbreviated Ell) is a 2-way fitting installed between two lengths of pipe to allow a change of direction, usually at a 90° or 45° angle.

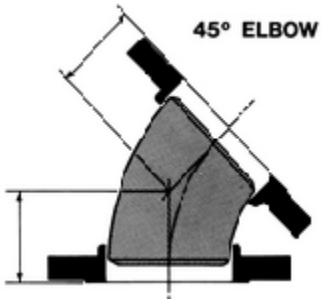
- **Long Radius Elbow**



  - Long Radius" means that the center to end dimension is 1½ times the nominal pipe size, i.e., radius = 1.5D where, D is diameter of pipe. A 6-inch pipe will have a 9-inch centerline radius.

  - The long radius 90° Ells are the default standard and the most recommended. Short radius elbow should only be used when tight space does permit the long radius.

- **Short Radius Elbow**



  - Short Radius means that the center to end dimension is equal to the nominal pipe size, i.e., radius = 1D. This means that the center-to-end for a 4" short radius Ell is 4", for a 10" Ell, the center-to-[illegible] and so on.

  - If the [illegible] on "45° Ell" next to the ell[illegible] since it is considered the de[illegible]

- **Long Radius Ta[illegible]**

  - Long radiu[illegible]ide a straight length at the end to accommodate a slip on the flange.

- **Reducing Elbow**