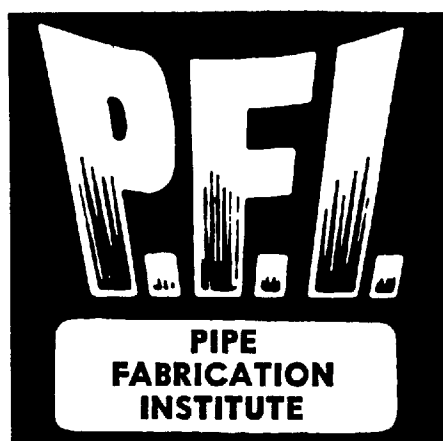


Method of Dimensioning Piping Assemblies

Prepared by
Pipe Fabrication Institute Engineering Committee



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PFI Standard ES-2
(Revised 1992)
(Reaffirmed 1994)

METHOD OF DIMENSIONING PIPING ASSEMBLIES

METRIC CONVERSIONS

The conversion of quantities between systems of units involves a determination of the number of significant digits to be retained. All conversions depend upon the intended precision of the original quantity and are rounded to the appropriate accuracy.

Pipe sizes together with applicable wall thicknesses are not shown with metric equivalents.

The SI (metric) values where included with the customary U. S. values in this Standard are the rounded equivalents of the U. S. values and are for reference only.

Metric units were derived utilizing the following conversion factor:

Conversion	Factor
inches to millimeter	25.4

1. Scope

- 1.1 This standard covers the recommended practices for dimensioning piping assemblies in a manner that would enable the fabricator to furnish a product meeting the geometry intended by the design engineer.

- (e) Type of branch connection, such as tee or nozzle
- (f) location of flanged or field welded joints
- (g) location of attachments
- (h) permissible tolerances (See PFI Std. ES-3)
- (i) material

2. Dimensioning

- 2.1 Piping is normally of a circular cross section. Thus the geometry of a piping system can be fully defined by the location of the centerline axis of the pipe. Terminal points and points of change in direction of the pipe axis are known as working points. Since two points determine a straight line, it is recommended that the pipe axes be located by means of working points. Two alternate methods of locating working points are suggested in 2.2 and 2.3.
- 2.2 Fig. 1A illustrates location of the working points along the axis of the pipe by providing information on the length and direction of each consecutive segment of the axis.
- 2.3 Fig. 1B illustrates dimensioning by means of location of the working points from fixed reference planes, such as from ground elevation, column lines, etc.
- 2.4 While not necessary for the determination of the pipeline geometry, it is essential that the engineer provide the fabricator with additional information such as:
- (a) radius of bend
 - (b) type of elbow
 - (c) gasket or other allowances
 - (d) pipe size and wall thickness

3. Fabrication Variables

- 3.1 In making the piping assemblies, the fabricator takes into account the following factors; root opening, shrinkage and fitting tolerances.
- 3.2 In order to assure full penetration to the root of a weld, the ends to be joined are set up with a small gap between them called root opening. This root opening may vary from 0 to $\frac{1}{4}$ " (6.0 mm) depending on the welding technique.
- 3.3 Shrinkage of the weld metal occurs in cooling. This shrinkage varies with welding process, technique, piping material and pipe wall thickness. On steel the weld shrinkage usually amounts to $\frac{1}{16}$ " (2.0 mm) to $\frac{1}{8}$ " (3.0 mm). Consequently the fabricator must make allowances for shrinkage. (See Paragraph 3.5.).
- 3.4 All standard welding fittings and flanges are subject to tolerances on terminal dimensions (end to end, face to face, or center to end, etc.). The tolerance on overall length of flanges as given in ANSI B16.5, is $\pm .06$ " (1.6 mm) for sizes up to and including 10" and $\pm .12$ " (3.2 mm) for larger sizes. ANSI B16.9 gives tolerances for butt welding fittings.

For 90° & 45° elbows & tees these are:

Size	Tol. (in.)	Tol. (mm)
1/2" - 8"	± .06	± 2
10"	± .09	± 2
12" - 24"	± .09	± 3
26" - 30"	± .12	± 3
32" - 48"	± .19	± 5

3.5 Due to the above factors only the fabricator is able to correctly determine root opening. The PFI recommends that these root openings not be shown on the engineers' design drawings for fabricators assemblies.

3.6 In certain situations, (reference welds marked "W" in Fig. 1A & 1B), when the design does not allow for intervening pipe segments, it may be necessary for the fabricator to vary root opening or trim components to hold overall dimensions (reference L'). Alternatively, and with permission from the purchaser's engineer, adjustment may be made in adjoining assemblies.

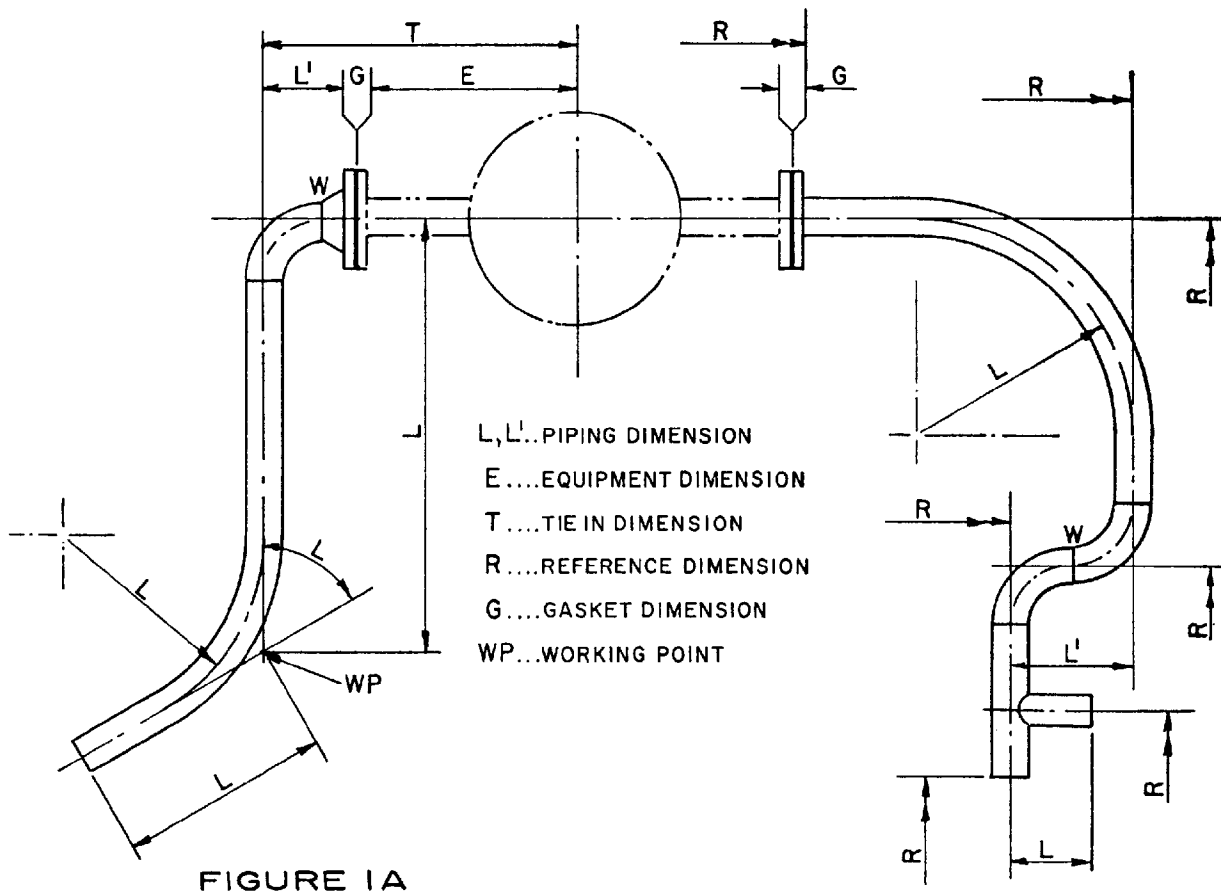


FIGURE 1A

FIGURE 1B

A current index of the latest revised ES Standards and Technical Bulletins is available from the Pipe Fabrication Institute.

PFI Standards and Technical Bulletins are published to serve proven needs of the pipe fabricating industry at the design level and in actual shop operations. Hence, such needs are continually considered and reviewed by the Engineering Committee of the Pipe Fabrication Institute to provide recommended procedures which have been demonstrated by collective experiences to fulfill requirements in a manner for Code compliance. However, as the PFI Standards are for minimum requirements the designer or fabricator always has the option of specifying supplementary conditions in the form of requirements beyond the scope of the PFI publications.