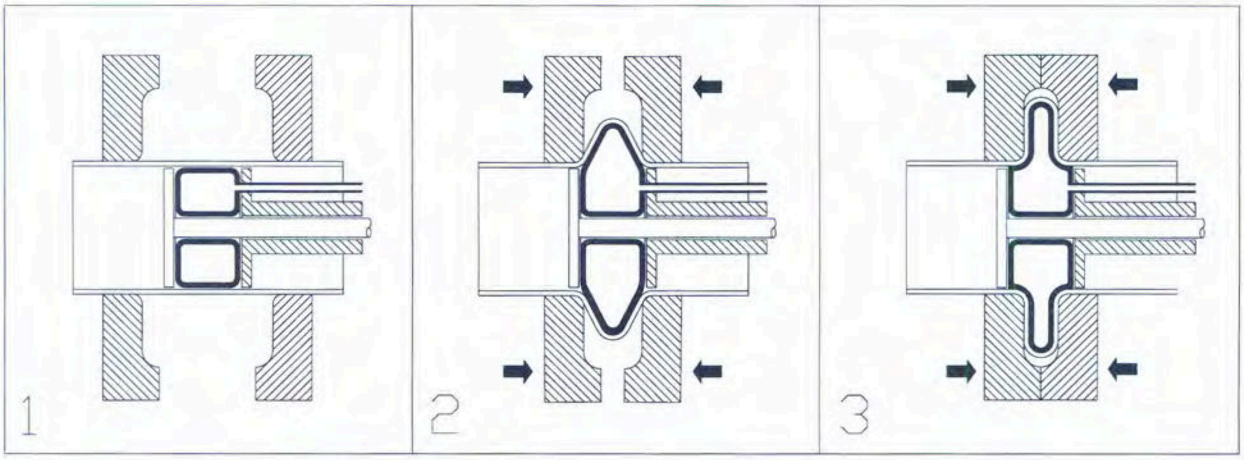
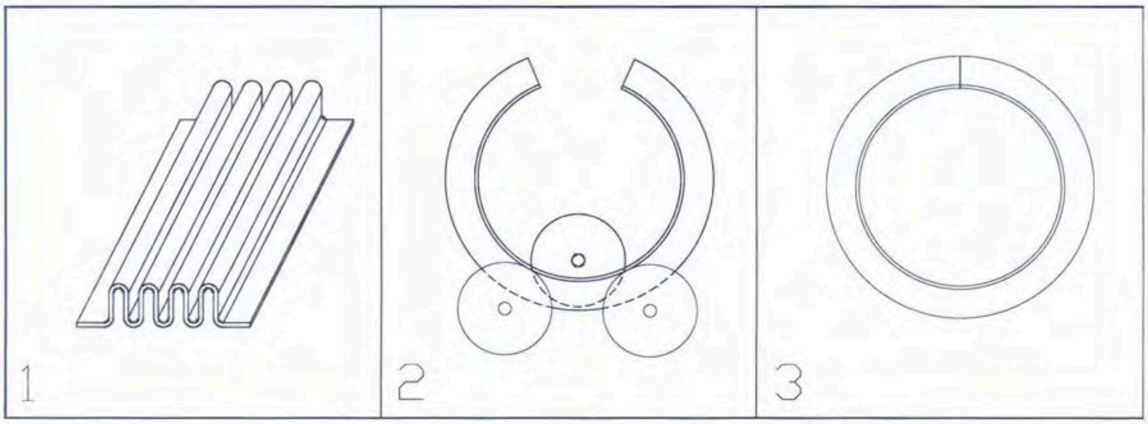
6.16.4 PNEUMATIC TUBE FORMING

This method is identical to "Elastomeric Forming" except that the initial bulge is formed by pressurizing a rubber "inner tube".



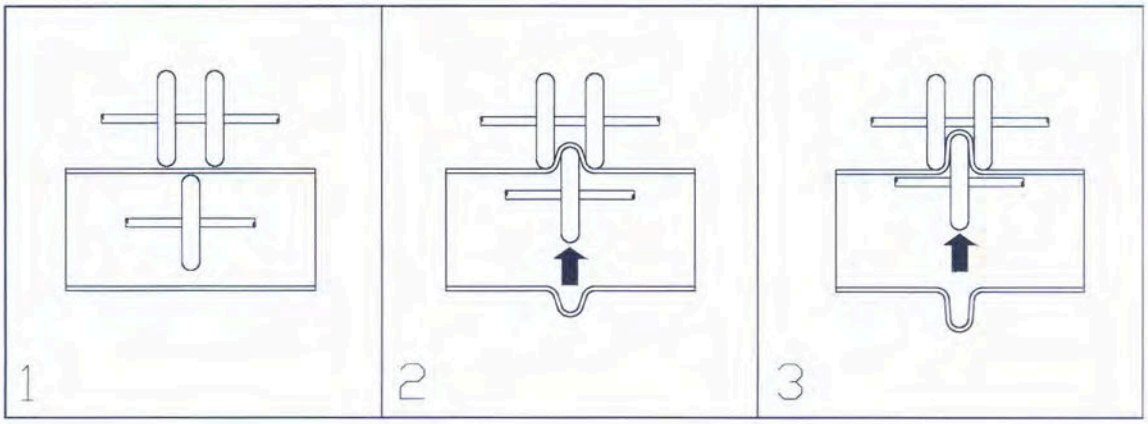
6.16.5 ROLLED CONVOLUTED SHEET

A flat sheet is mechanically convoluted by either the press-brake method or the roll forming method modified to produce straight sections. This pre-formed rail is then rolled into a tube. The bellows is completed by longitudinally welding the convoluted ends of the rail together.



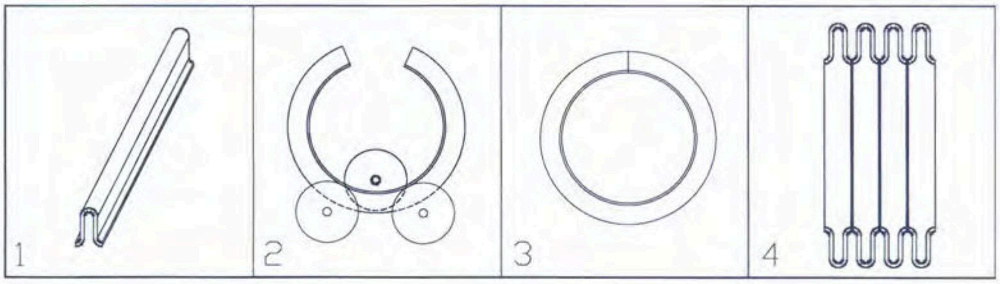
6.16.6 ROLL FORMING

A tube is placed in a forming machine and individual or multiple convolutions are formed by means of pressure exerted by forming wheels. Generally, the wheels are on both the inside and outside of the tube. Controlled longitudinal shortening of the bellows tube occurs during the forming operation. The tube may rotate about fixed-shaft forming wheels, or the tube may be fixed and the wheels rotated about the tube's circumference. The example below shows the fixed-shaft method.



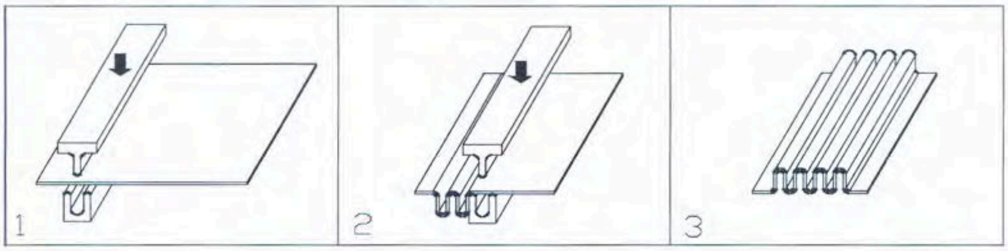
6.16.7 ROLLED RING

A flat sheet is formed into a single convolution and then rolled into a ring. The ring is completed by a longitudinal weld across the convolution. If more than one convolution is desired, the bellows is built up by a series of circumferential welds joining the convolutions together.



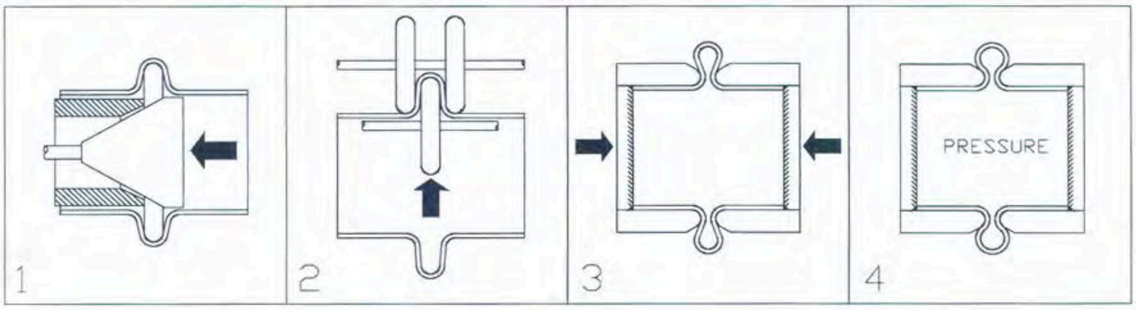
6.16.8 PRESS-BRAKE FORMING

A flat sheet is convoluted using a press-brake die to form the individual convolutions. This method is used primarily in the manufacture of bellows for rectangular Expansion Joints described in Section 5. Many convolution profiles can be achieved using this method. The most common styles are the “U” profile and “V” profiles shown in Figure 5.9. Material availability and press-break tooling limit the length of the rail. Longer lengths can be manufactured by splicing the rails together with longitudinal welds.



6.16.9 COMBINED FORMING

Some of the methods described in previous sections can be combined. One procedure for forming a toroidal bellows (Figure 4.15) combines two methods. A convolution is expansion formed with a convolution height greater than the final desired torus height. The convolution is located between forming rings similar to hydraulic forming. The rings are then pushed together and the toroid is hydraulically formed.



6.17 FABRICATION TOLERANCES

This Section covers standard manufacturing tolerances for fabricated assemblies containing Expansion Joints. If required, closer tolerances than those indicated may be obtained but must be subject to agreement between the purchaser and the manufacturer of the Expansion Joint.

Flanges for Round Expansion Joints
(Up to 96 in. (2400 mm) Nominal Diameter)

Standard Flanges: Flanges to standards such as ANSI B16.47, B16.5, MSS SP44, AWWA C207	Dimensions and tolerances conform to the standard.
Non-Standard Machined Flanges: Including plate flanges with standard drilling	Flanges to be faced and drilled. Drilling tolerance for bolt, circle and hole location same as standard. Minimum thickness to be specified
Non-Standard Unmachined Flanges: Rolled angle, rolled bar, flame cut plate flanges, etc.	All dimensions are nominal.

LENGTH TOLERANCE (Measured between working points):

± 1/8 in. up through 3 ft.	± 3 mm up through 1m
± 1/4 in. above 3 ft. through 12 ft.	± 6 mm above 1m up through 4m
± 3/8 in. over 12 ft.	± 10 mm above 4m

THIS SYMBOL DESIGNATES WORKING POINT:

Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5mm)

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

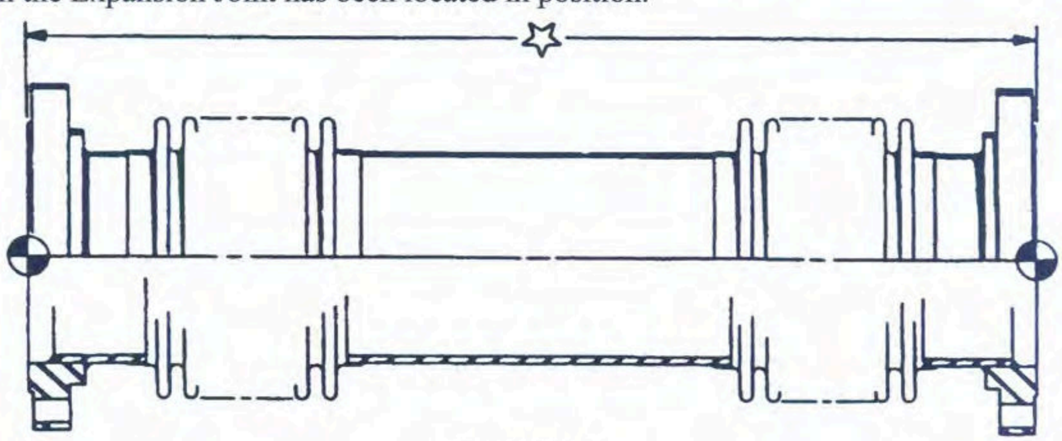
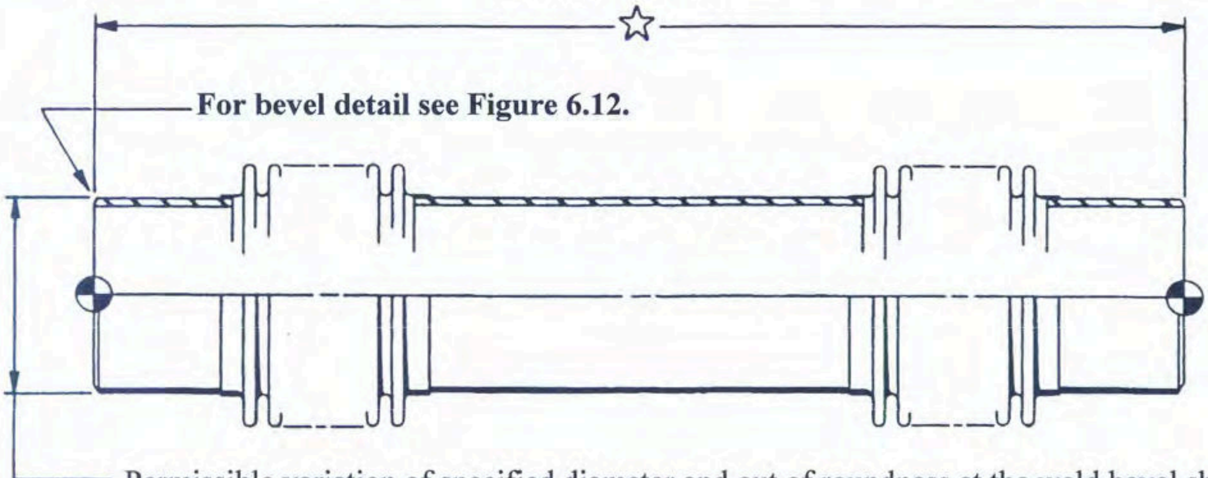
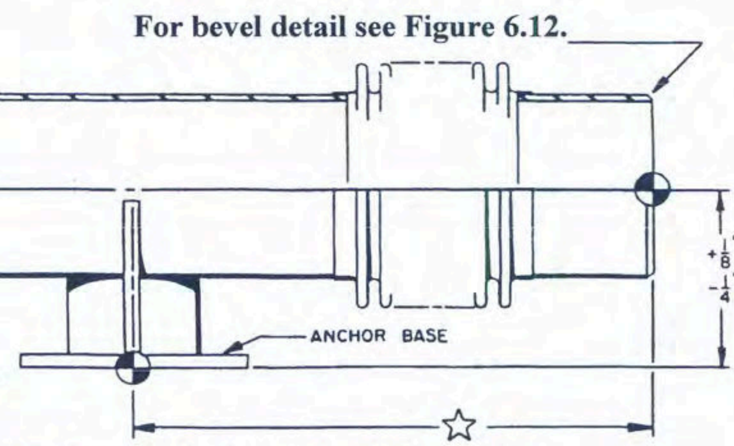


FIGURE 6.1



Permissible variation of specified diameter and out of roundness at the weld bevel shall be in accordance with the following:
24 in. (600 mm) diameter or less in accordance with pipe specification.
Over 24 in. (600 mm) diameter: Outside diameter 0.5% of the specified outside diameter based on circumferential measurement.
Out-of-roundness: Difference between major and minor diameters not to exceed 1% of nominal diameter.

FIGURE 6.2



Permissible variation of specified diameter and out of roundness at the weld bevel shall be in accordance with the following:
24 in. (600 mm) diameter or less in accordance with pipe specification.
Over 24 in. (600 mm) diameter: Outside diameter 0.5% of the specified outside diameter based on circumferential measurement.
Out-of-roundness: Difference between major and minor diameters not to exceed 1% of nominal diameter.

FIGURE 6.3

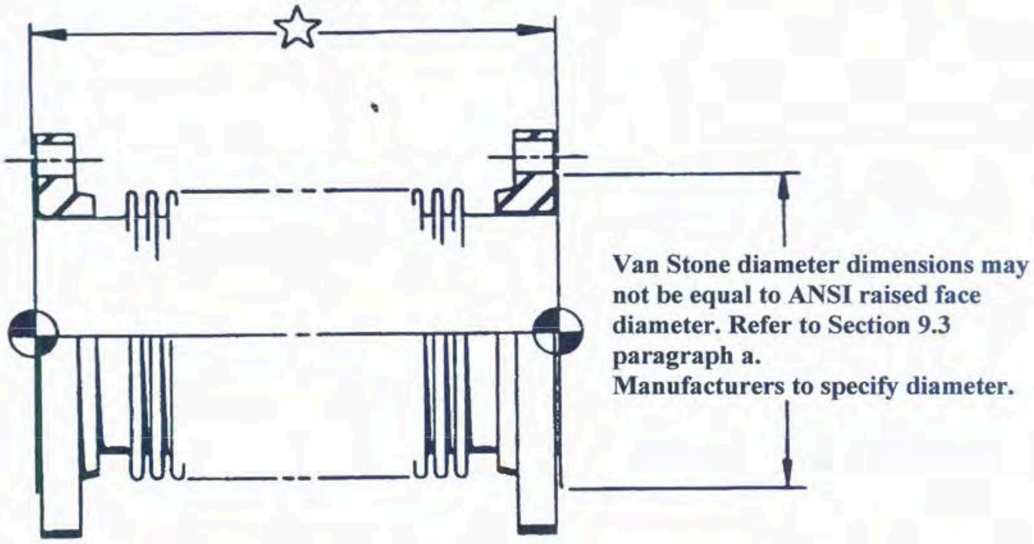


FIGURE 6.4

Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5 mm).

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

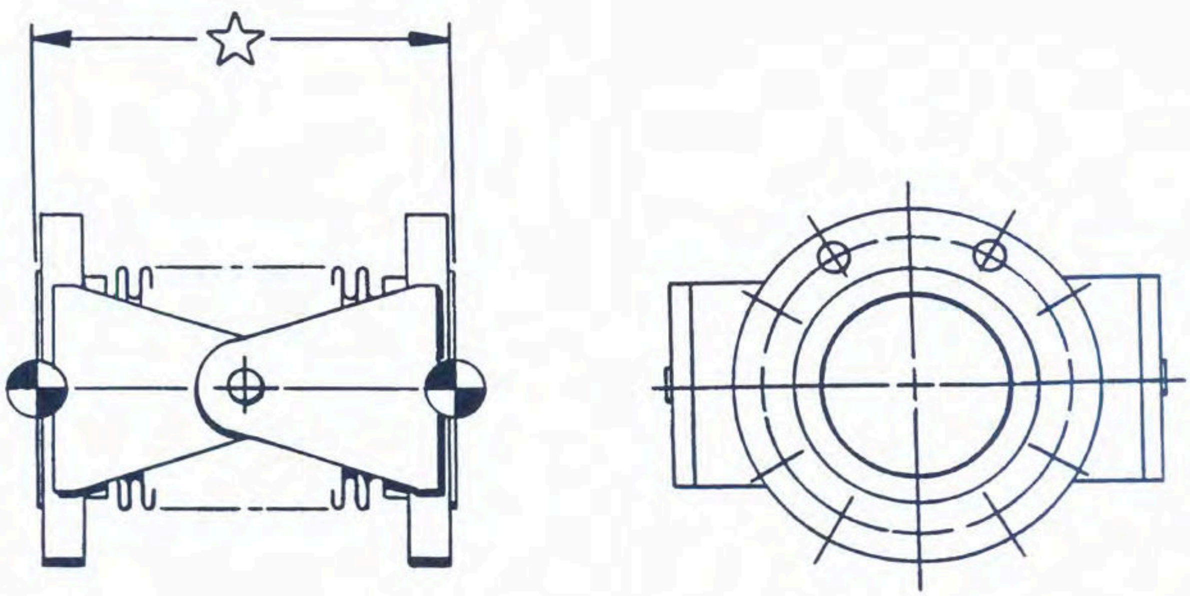
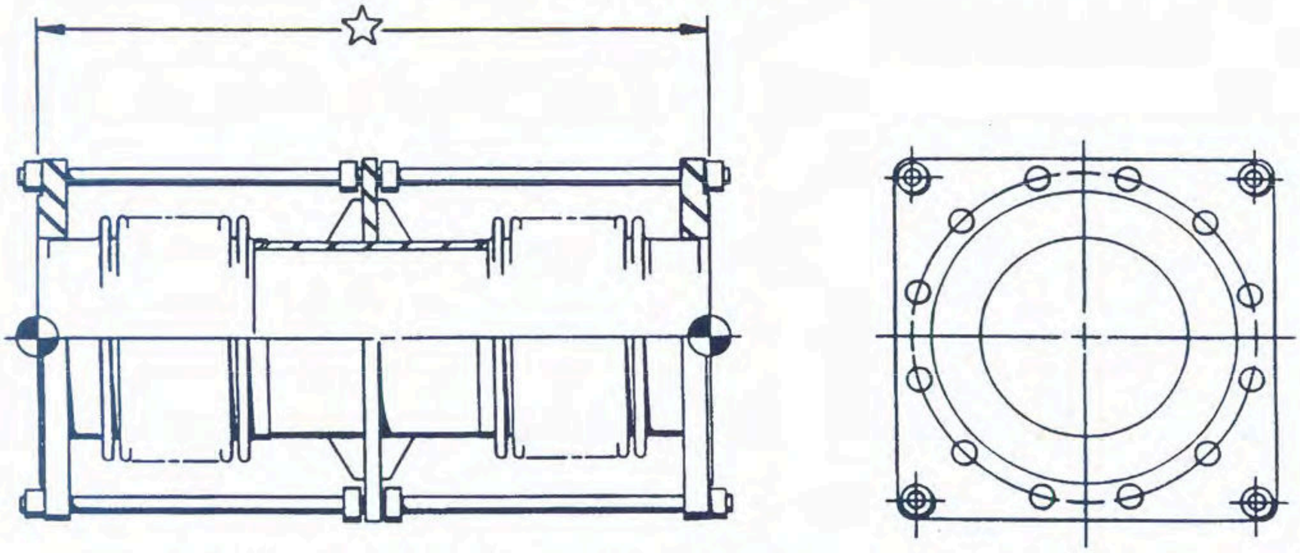


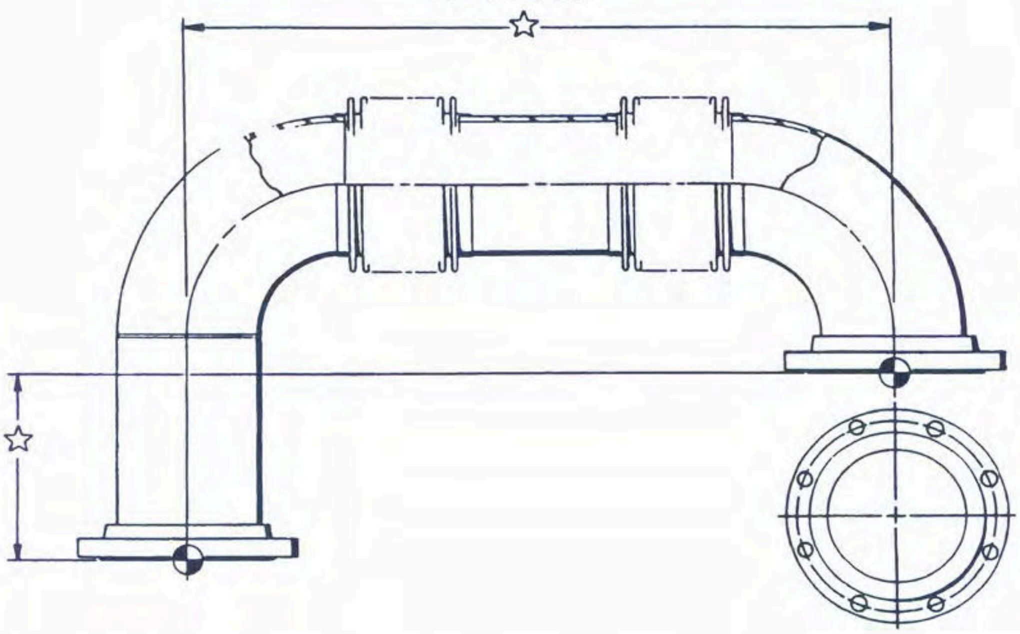
FIGURE 6.5



Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5 mm).

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

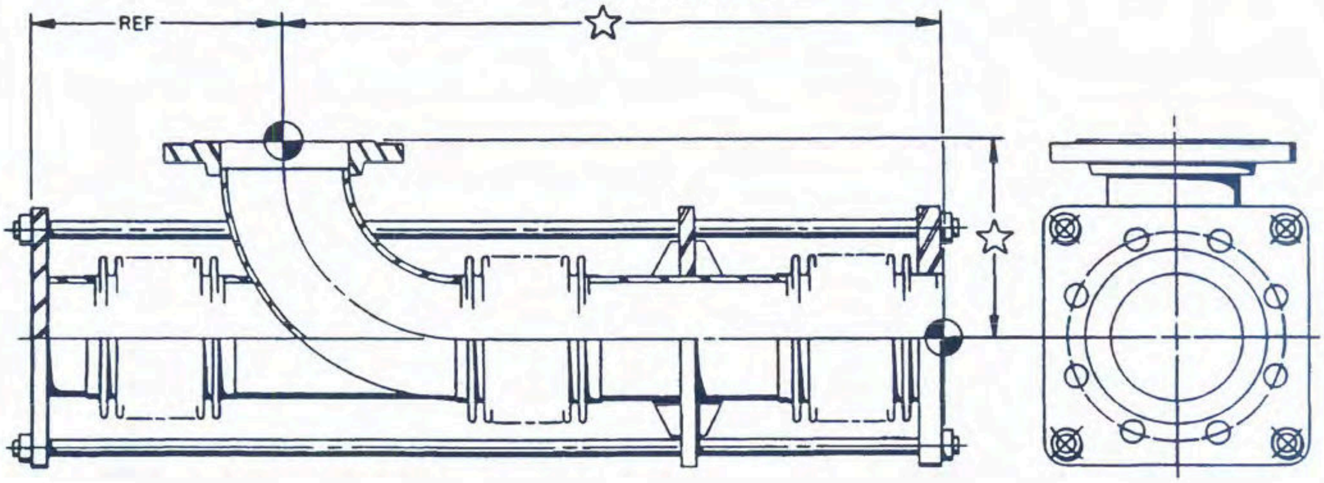
FIGURE 6.6



Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5 mm).

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

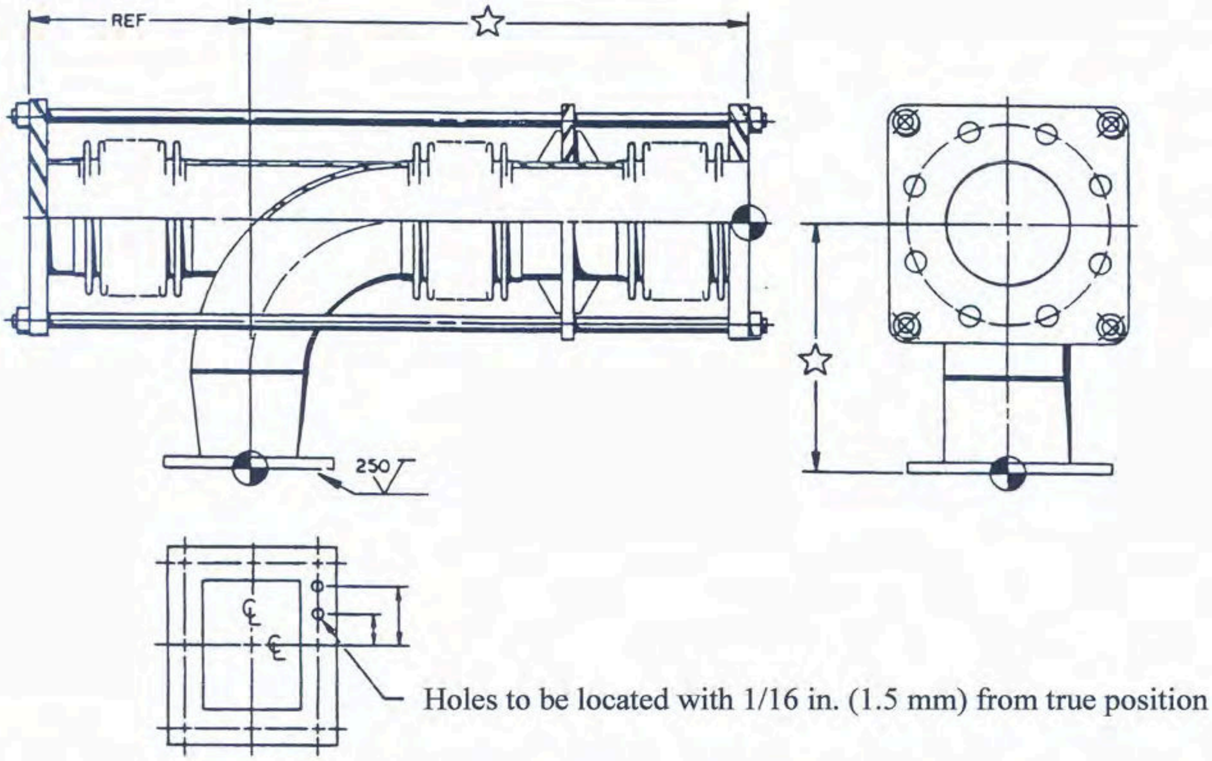
FIGURE 6.7



Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5 mm).

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

FIGURE 6.8



Flange face at turbine connection to be flat within 1/16 in. (1.5 mm)

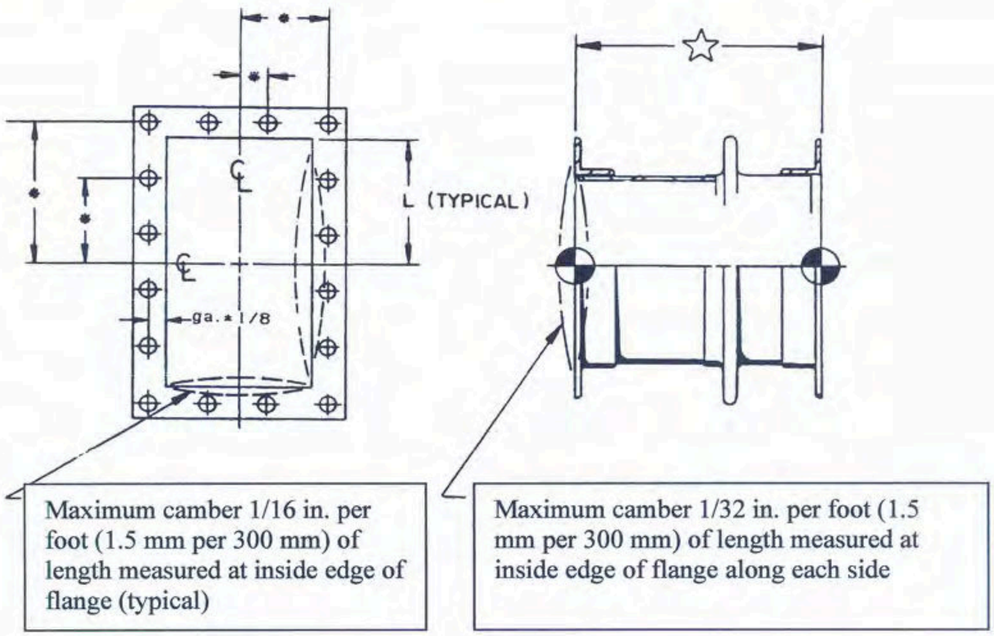
Flanges must be installed so that bolt holes straddle a common centerline within 1/16 in. (1.5 mm).

NOTE: Good practice suggests that one mating flange in the piping system remain unwelded until the Expansion Joint has been located in position.

NOTE: Design of the duct must provide for field fit-up connection to allow proper alignment of the Expansion Joint and duct, without producing unanticipated loadings in the system. Closer tolerances than those indicated shall be subject to agreement between the purchaser and Expansion Joint manufacturer.

FLANGED EXPANSION JOINT WITH MACHINED PLATE FLANGES
For Turbine Type Application Including Boiler Feed
Pump Turbine Exhaust

FIGURE 6.9



*Holes to be located within 1/8 in. (3 mm) of true position for L up to 12 ft (4 m) and within 3/16 in. (5 mm) of true position for L greater than 12 ft (4 m).

NOTE: Options for providing true hole locations:

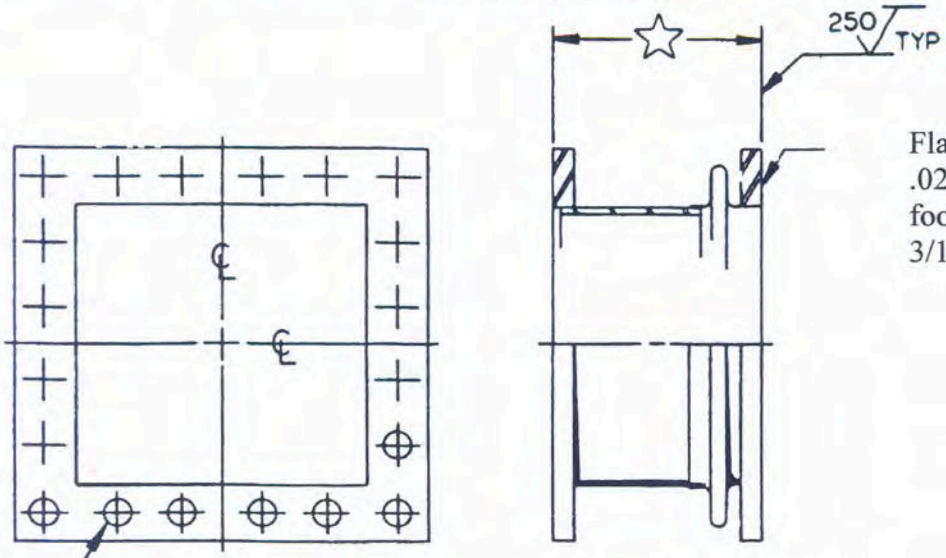
1. Purchaser may provide manufacturer with template having the desired hole size and pattern.
2. Purchaser may request blank flange or flanges with drilling to be made by constructor at installation.
3. Expansion Joint manufacturer may provide loose mating flanges.

Closer tolerances than those indicated shall be subject to agreement between the purchaser and Expansion Joint manufacturer.

RECTANGULAR EXPANSION JOINT

With Angle Type Flanges or 1/2 in. (13 mm) Maximum Thickness Plate Flanges
(All flange faces are mill finish)

FIGURE 6.10



Flange face to be flat within .020 in. (0.5 mm) in any one foot length and a maximum 3/16 in. (5 mm) T.I.R. overall

Holes to be located within 1/8 in. (3 mm) of true position

Closer tolerances than those indicated shall be subject to agreement between the purchaser and Expansion Joint manufacturer.

NOTE: Options for providing true hole locations:

1. Purchaser may provide manufacturer with template having the desired hole size and pattern.
2. Purchaser may request blank flange or flanges with drilling to be made by constructor at installation.
3. Expansion Joint manufacturer may provide loose mating flanges.

RECTANGULAR EXPANSION JOINT
With Plate Type Flanges Having Machined Faces

FIGURE 6.11

