Determination of End Cap Flange Thickness

The curves of Figures 7 through 12 of this report enable one to determine the correct thickness of a flat end cap used as a closure for a cylindrical pressure vessel. The collapse depth in these curves is based on the theory of bending of a flat plate. However, another mode of possible failure exists, that of shearing of the cap over a cylindrical area that forms the boundary of the unsupported plate (see sketch on accompanying curve sheet). If the plate is kept full thickness throughout, this mode of failure is unlikely; but it is common practise to machine away a portion of the outer part of the plate so that a plug portion can enter the cylinder, probably containing an o-ring seal. If the remaining flange or full diameter portion of the plate does not have sufficient thickness, a shear type failure could result. The attached curve sheet is a plot of the dimensionless ratios flange thickness-to-unsupported diameter and collapse (failure) pressure-to-shear yield strength.

Yield strength in shear is commonly taken as 0.57 times the tensile yield strength. After a suitable end cap has been designed using Figures 7-12, the designer can determine required flange thickness from the present curve. As with all the other curves a selected factor of safety should be applied to the value given by the curve.