Diffusers and nozzles

In the specific case of steady flow in a diffuser the loss coefficient is defined as

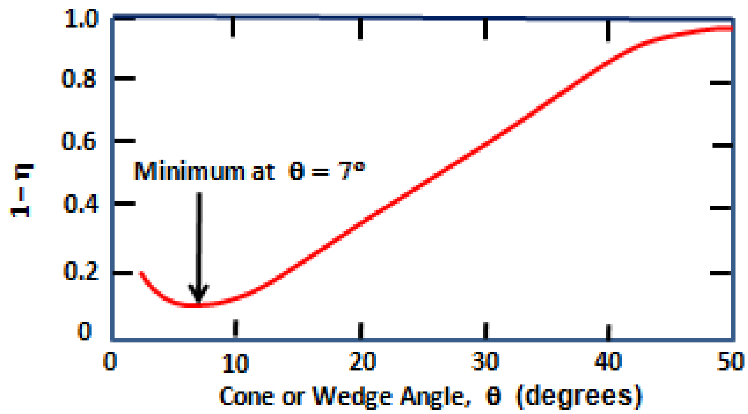

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Figure 1: Diffuser performance ($1 - \eta$ where η is the diffuser efficiency).

$$K = \frac{2g\Delta H}{u_1^2} \quad \text{(Bfe1)}$$

and the value of

$$\eta = 1 - \frac{K}{\left\{1 - \frac{A_1^2}{A_2^2}\right\}} \quad \text{(Bfe2)}$$

is often referred to as the **diffuser efficiency**. This efficiency would be zero if there is no pressure recovery and unity in the case of full pressure recovery. In practice, the actual efficiency, η, depends on the diffuser geometry and sometimes other factors such as the uniformity of the entering flow. Typical efficiency for conical diffusers are indicated in Figure 1 where $1 - \eta$ is plotted against the angle, θ, of the cone. Note that the optimal diffuser has a cone angle of about 7^o. Larger angles lead to flow separation within the diffuser which causes large viscous losses. Smaller angles imply diffusers which become too long leading to larger viscous, wall friction losses. For the variations in a large variety of diffuser geometries the reader should consult compendiums such as Idelchik (1994), or Crane (1957).