Orifice Plate Expansion Factor @model

@wikipedia

A ratio between compressible fluid volumetric flowrate and incompressible fluid volumetric flowrate through the ideal orifice:

(1) $$\epsilon = \frac{q_{\rm compressible}}{q_{\rm incompressible}}$$

where

(2) $$q_{\rm incompressible} = \frac{\pi d^2}{4} \cdot \sqrt{\frac{2 \cdot \Delta p}{\rho \cdot (1-\beta^4)}}$$

and

Δp	pressure drop on the choke, $\Delta p = p_{in} - p_{out}$
$\beta = \frac{d}{D}$	orifice narrowing ratio
d	orifice diameter
D	pipe diameter

For incompressible fluids and slightly compressible fluid (water and most types of oil) the expansion factor is $\epsilon = 1$.

For Strongly Compressible Fluid (condensate, steam and gases) the expansion factor is $\epsilon < 1$.

The most popular engineering correlation covering various tapping arrangements is given by ISO5167:

(3) $$\epsilon = 1 - (0.351 + 0.256\,\beta^4 + 0.93\,\beta^8) \cdot \left[1 - \left(\frac{p_{out}}{p_{in}} \right)^{1/\kappa} \right]$$

where

p_{in}	intake pressure
p_{out}	discharge pressure
$\beta = \frac{d}{D}$	orifice narrowing ratio
κ	Isentropic exponent (), in express analysis can be taken as ~ 1.3

See also

Physics / Fluid Dynamics / Pipe Flow Dynamics / Pipe Flow Simulation (PFS) / Pipeline Choke @model

[Orifice Plate Discharge Coefficient]