Orifice Plate Discharge coefficient @ model

@wikipedia

A ratio between actual volumetric flowrate through the real orifice and volumetric flowrate estimate through the ideal orifice:

(1) $$C_d = \frac{q}{q_{\rm ideal}}$$

where

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

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
ϵ	expansion factor

The deviation from ideal estimation (2) arise from fluid friction with choke elements and possible flow turbulence.

The discharge coefficient C_d is a function of a choke narrowing ratio β and Reynolds number $\rm Re$ in the pipe:

(3) $$C_d = C_d(\beta, {\rm Re})$$

where

(4) $${\rm Re} = \frac{v \cdot D}{\nu} = \frac{4\, q}{\pi \, D \, \nu}$$

where

ν	kinematic viscosity
v	cross-sectional average flow velocity in a pipe

It can be estimated for popular choke types or tabulated in laboratory.

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

(5) $$C_d = 0.5961 + 0.0261 \cdot \beta^2 - 0.216 \cdot \beta^8 + 0.000521 \cdot \left(\frac{10^6 \, \beta}{\rm Re} \right)^{0.7}$$

See also

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

[Orifice Plate Expansion Factor @ model]

Pipeline Engineering / Pipeline / Choke

Reference

ISO5167 – Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full

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Stolz,J.,"A Universal Equation for the Calculation of Discharge Coefficient of Orifice Plates";, Proc. Flomeko 1978-Flow Measurement of Fluids,H. H. Dijstelbergenand E. A.Spencer(Eds), North-HollandPublishingCo.,Amsterdam (1978), pp 519-534