Cheatography

Calculate Flow from Pressure Measurement Cheat Sheet

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Introduction: Flow in a Pipe/Tube

Several factors determine the pressure drop that occurs in fluid flow applications including laminar versus turbulent flow, the flow velocity, kinematic viscosity and Reynolds number of the fluid, internal roughness of the inside of the pipe as well as its diameter, length and form factor. Orifice plates, Venturi tubes and nozzles simplify the situation. In these cases (refer to Figure 1), the flow is related to ΔP (P1-P2) by the equation:

Credit: https://allsensors.com/engineering-resources/white-papers/pressure-point-11-calculating-flow-rate-from-pressure-measurements

Formula

$$q = c_D \pi/4 \, D_2^2 \, [2(P_1-P_2) / \rho(1 - d^4)]^{1/2}$$

Where:

q is the flow in m^3/s

c_D is the discharge coefficient, and is the area ratio = A_2/A_1

P_1 and P_2 are in N/m^2

ρ is the fluid density in kg/m^3

D_2 is the orifice, venturi or nozzle inside diameter (in m)

D_1 is the upstream and downstream pipe diameter (in m)

and $d = D_2/D_1$ diameter ratio

For fluid flow measurements, orifice plates, venturi tubes and nozzles simplify the use of differential pressure (ΔP) sensors to determine the flow rate. In these cases, the flow is related to ΔP (P1-P2) by the equation

Conclusion

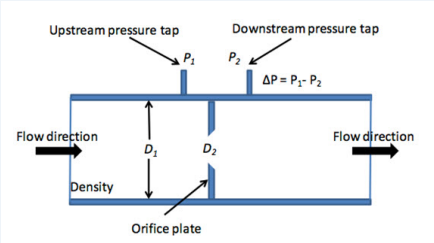
The most common use of pressure sensors to calculate another parameter is flow.

This technique is also used to measure air flow of blowers, air flow through filters, vent hoods, gas boilers, or in heating ventilation and air conditioning (HVAC) variable air volume (VAV) controllers.

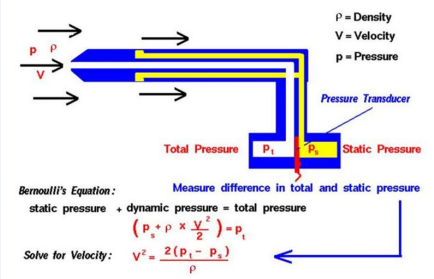
In medical applications, drug delivery (liquid flow) uses differential pressure sensors to measure flow rates of 0.5-10.0 microliters/min.

Many gas flow measurements are also made with pressure sensors.

Elements of a ΔP flow measurement



Pitot tubes



Use the difference between total pressure and static pressure to calculate the velocity of the aircraft or fluid flowing in the pipe or enclosure. A Pitot-static tube for measuring aircraft velocity is shown above'

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Published 31st August, 2017.
Last updated 31st August, 2017.