Summary Document

The Darcy Weisbach equation defies an empirical relationship between head loss or pressure loss due to friction along a given length of pipe and the average velocity of the fluid flow for an incompressible fluid.

**Forms of the Darcy-Weisbach equation**

The head loss expresses the pressure loss due to friction in terms of the equivalent height of column of the working fluid, so that the pressure drop is…

The head loss () of a pipe would be defined as

l=length of pipe (m), =inner pipe diameter (m), = sum of minor loss coefficients, v= velocity of fluid (m/s)), g = gravitational acceleration m/s^2.

**Pressure Loss Form**

(Pa) is the total pressure loss due to friction

is a friction factor co-efficient

L(m) is the length of pipe

D(m) is the pipe internal diameter

(m/s) is the average fluid velocity

is the fluid density

**Laminar Regime**

In the laminar regime the flow of the fluid is defined by **Poiseuille’s law**

Where the Reynold’s Number is defined as

Where is the density of the fluid, is the dynamic viscosity of the fluid (kg/(ms)), <v> is the mean flow velocity, which would be measured experimentally as the volumetric flow rate Q per unit cross sectional wetted area and D is the characteristic length.

Laminar flow exists when the Reynold’s Number Re < 2000. Friction loss arises from the transfer of momentum from the fluid in the centre of the flow to the pipe wall via the viscosity of the fluid. As the flow is laminar there are no vortices present in the flow. Also because the friction loss is proportional to the flow velocity rather than proportional to the square of the velocity, one can regard the Darcy-Weisbach equation as not applying.

For wholly turbulent flow, where the Reynold’s number is relatively large, the friction factor is independent of the Reynold’s number and is a function of relative roughness only. Between laminar flow and wholly turbulent flow the friction factor depends on both the Reynold’s Number and the relative roughness.

For the entire turbulent flow range, friction factors can be read from a Moody chart or can be calculated using the **Colebrook formula**.

Which is an empirical fit of the pipe flow data. For hydraulically smooth () pipe the friction factor is given by the **Blasius formula**

[Introducing Thermal Systems]

**Critical Regime**

Nikuradse Equation (Re>=10)

Colebrook-White Equation

Moody Equation (1947)

Wood Equation (1966)

Eck Equation (1973)

Churchill Equation (1973)

Jain and Swamee (1976)

Jain (1976)

Second Churchill Equation (1977)

Chen Equation (1979)

Round Equation (1980)

Barr Equation (1981)

Zigrang and Sylvester (1982)

Haaland equation (1983)

Serghides equation (1984)

or

where

Mandilli equation (1997)

Monzon, Romeo and Royo (2002)

Dobromyslov Equation (2004)

Where

And

Goudar and Sonnad equation (2006)

Where

Rao and Kumar equation (2006)

Where

Vatankhah and Kouchakzadeh equation (2008)

Where

Buzzelli equation (2008)

where

Goundar and Sonnad approximation (2008)

Where

Avci and Kargoz

Evangleids, Papaevangelou and Tzimopoulos

Brkic solution based on Lambert W-function

Where

Clamond

Where

Dunlop cubic interpolation for 2000 <=Re<=4000

Where