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Darcy Weisbach Equation Formulas

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List of 26 Darcy Weisbach Equation Formulas

Darcy Weisbach Equation

1) Area of Pipe given Total Required Power

Open Calculator

fx $$A = \frac{P}{L_p \cdot dp|dr \cdot V_{mean}}$$

ex $$2m^2 = \frac{34.34W}{0.10m \cdot 17N/m^3 \cdot 10.1m/s}$$

2) Density of Fluid given Friction Factor

Open Calculator

fx $$\rho_{Fluid} = \mu \cdot \frac{64}{f \cdot D_{pipe} \cdot V_{mean}}$$

ex $$1.279875kg/m^3 = 10.2P \cdot \frac{64}{5 \cdot 1.01m \cdot 10.1m/s}$$

3) Density of Liquid given Shear Stress and Darcy Friction Factor

Open Calculator

fx $$\rho_{Fluid} = 8 \cdot \frac{\tau}{f \cdot V_{mean} \cdot V_{mean}}$$

ex $$1.460249kg/m^3 = 8 \cdot \frac{93.1Pa}{5 \cdot 10.1m/s \cdot 10.1m/s}$$

4) Density of Liquid using Mean Velocity given Shear Stress with Friction Factor

Open Calculator

fx $$\rho_{Fluid} = 8 \cdot \frac{\tau}{f \cdot \left(V_{mean}^2\right)}$$

ex $$1.460249\text{kg/m}^3 = 8 \cdot \frac{93.1\text{Pa}}{5 \cdot \left((10.1\text{m/s})^2\right)}$$

5) Diameter of Pipe given Friction Factor

Open Calculator

fx $$D_{pipe} = \frac{64 \cdot \mu}{f \cdot V_{mean} \cdot \rho_{Fluid}}$$

ex $$1.055243\text{m} = \frac{64 \cdot 10.2\text{P}}{5 \cdot 10.1\text{m/s} \cdot 1.225\text{kg/m}^3}$$

6) Diameter of Pipe given Head Loss due to Frictional Resistance

Open Calculator

fx $$D_{pipe} = f \cdot L_p \cdot \frac{V_{mean}^2}{2 \cdot [g] \cdot h}$$

ex $$1.040213\text{m} = 5 \cdot 0.10\text{m} \cdot \frac{(10.1\text{m/s})^2}{2 \cdot [g] \cdot 2.5\text{m}}$$

7) Dynamic Viscosity given Friction Factor

Open Calculator

$$\mu = \frac{f \cdot V_{mean} \cdot D_{pipe} \cdot \rho_{Fluid}}{64}$$

$$9.762676\text{P} = \frac{5 \cdot 10.1\text{m/s} \cdot 1.01\text{m} \cdot 1.225\text{kg/m}^3}{64}$$

8) Head Loss due to Frictional Resistance

Open Calculator

$$h = f \cdot L_p \cdot \frac{V_{mean}^2}{2 \cdot [g] \cdot D_{pipe}}$$

$$2.574783\text{m} = 5 \cdot 0.10\text{m} \cdot \frac{(10.1\text{m/s})^2}{2 \cdot [g] \cdot 1.01\text{m}}$$

9) Length of Pipe given Head Loss due to Frictional Resistance

Open Calculator

$$L_p = \frac{h \cdot 2 \cdot [g] \cdot D_{pipe}}{f \cdot V_{mean} \cdot 2}$$

$$0.490332\text{m} = \frac{2.5\text{m} \cdot 2 \cdot [g] \cdot 1.01\text{m}}{5 \cdot 10.1\text{m/s} \cdot 2}$$

10) Pressure Gradient given Total Required Power

Open Calculator

$$dp|dr = \frac{P}{L_p \cdot A \cdot V_{mean}}$$

$$17\text{N/m}^3 = \frac{34.34\text{W}}{0.10\text{m} \cdot 2\text{m}^2 \cdot 10.1\text{m/s}}$$

11) Reynolds Number given Friction Factor

Open Calculator

fx $$\mathrm{Re} = \frac{64}{\mathrm{f}}$$

ex $$12.8 = \frac{64}{5}$$

12) Shear Stress given Friction Factor and Density

Open Calculator

fx $$\tau = \rho_{\mathrm{Fluid}} \cdot \mathrm{f} \cdot \mathrm{V}_{\mathrm{mean}} \cdot \frac{\mathrm{V}_{\mathrm{mean}}}{8}$$

ex $$78.10141\mathrm{Pa} = 1.225\mathrm{kg/m^3} \cdot 5 \cdot 10.1\mathrm{m/s} \cdot \frac{10.1\mathrm{m/s}}{8}$$

13) Shear Velocity

Open Calculator

fx $$\mathrm{V}_{\mathrm{shear}} = \mathrm{V}_{\mathrm{mean}} \cdot \sqrt{\frac{\mathrm{f}}{8}}$$

ex $$7.984751\mathrm{m/s} = 10.1\mathrm{m/s} \cdot \sqrt{\frac{5}{8}}$$

14) Total Required Power

Open Calculator

fx $$\mathrm{P} = \mathrm{dp|dr} \cdot \mathrm{A} \cdot \mathrm{V}_{\mathrm{mean}} \cdot \mathrm{L}_{\mathrm{p}}$$

ex $$34.34\mathrm{W} = 17\mathrm{N/m^3} \cdot 2\mathrm{m^2} \cdot 10.1\mathrm{m/s} \cdot 0.10\mathrm{m}$$

Friction Factor

15) Friction Factor

Open Calculator

$$f = 64 \cdot \frac{\mu}{\rho_{Fluid} \cdot V_{mean} \cdot D_{pipe}}$$

$$5.223978 = 64 \cdot \frac{10.2P}{1.225kg/m^3 \cdot 10.1m/s \cdot 1.01m}$$

16) Friction Factor given Reynolds Number

Open Calculator

$$f = \frac{64}{Re}$$

$$5 = \frac{64}{12.8}$$

17) Friction Factor given Shear Stress and Density

Open Calculator

$$f = \frac{8 \cdot \tau}{V_{mean} \cdot V_{mean} \cdot \rho_{Fluid}}$$

$$5.9602 = \frac{8 \cdot 93.1Pa}{10.1m/s \cdot 10.1m/s \cdot 1.225kg/m^3}$$

18) Friction Factor given Shear Velocity

Open Calculator

fx $$f = 8 \cdot \left(\frac{V_{shear}}{V_{mean}} \right)^2$$

ex $$6.352318 = 8 \cdot \left(\frac{9\text{m/s}}{10.1\text{m/s}} \right)^2$$

19) Friction Factor when Head Loss is due to Frictional Resistance

Open Calculator

fx $$f = \frac{h \cdot 2 \cdot [g] \cdot D_{pipe}}{L_p \cdot V_{mean}^2}$$

ex $$4.854777 = \frac{2.5\text{m} \cdot 2 \cdot [g] \cdot 1.01\text{m}}{0.10\text{m} \cdot (10.1\text{m/s})^2}$$

Mean Velocity of Flow

20) Mean Velocity of Flow given Friction Factor

Open Calculator

fx $$V_{mean} = \frac{64 \cdot \mu}{f \cdot \rho_{Fluid} \cdot D_{pipe}}$$

ex $$10.55243\text{m/s} = \frac{64 \cdot 10.2\text{P}}{5 \cdot 1.225\text{kg/m}^3 \cdot 1.01\text{m}}$$

21) Mean Velocity of Flow given Head Loss due to Frictional Resistance

Open Calculator

fx $$V_{mean} = \sqrt{\frac{h \cdot 2 \cdot [g] \cdot D_{pipe}}{f \cdot L_p}}$$

ex $$9.952244\text{m/s} = \sqrt{\frac{2.5\text{m} \cdot 2 \cdot [g] \cdot 1.01\text{m}}{5 \cdot 0.10\text{m}}}$$

22) Mean Velocity of Flow given Maximum Velocity at Axis of Cylindrical Element

Open Calculator

fx $$V_{mean} = 0.5 \cdot V_{max}$$

ex $$10.1\text{m/s} = 0.5 \cdot 20.2\text{m/s}$$

23) Mean Velocity of Flow given Shear Stress and Density

Open Calculator

fx $$V_{mean} = \sqrt{\frac{8 \cdot \tau}{\rho_{Fluid} \cdot f}}$$

ex $$11.02724\text{m/s} = \sqrt{\frac{8 \cdot 93.1\text{Pa}}{1.225\text{kg/m}^3 \cdot 5}}$$

24) Mean Velocity of Flow given Shear Velocity

Open Calculator

fx $$V_{mean} = \frac{V_{shear}}{\sqrt{\frac{f}{8}}}$$

ex $$11.3842\text{m/s} = \frac{9\text{m/s}}{\sqrt{\frac{5}{8}}}$$

25) Mean Velocity of Flow given Total Required Power

Open Calculator

fx $$V_{mean} = \frac{P}{L_p \cdot dp|dr \cdot A}$$

ex $$10.1\text{m/s} = \frac{34.34\text{W}}{0.10\text{m} \cdot 17\text{N/m}^3 \cdot 2\text{m}^2}$$

26) Mean Velocity of Fluid Flow

Open Calculator

fx $$V_{mean} = \left(\frac{1}{8 \cdot \mu}\right) \cdot dp|dr \cdot R^2$$

ex $$8.333333\text{m/s} = \left(\frac{1}{8 \cdot 10.2\text{P}}\right) \cdot 17\text{N/m}^3 \cdot (2\text{m})^2$$

Variables Used

- **A** Cross Sectional Area of Pipe *(Square Meter)*
- D_{pipe} Diameter of Pipe *(Meter)*
- **dp|dr** Pressure Gradient *(Newton per Cubic Meter)*
- **f** Darcy Friction Factor
- **h** Head Loss due to Friction *(Meter)*
- L_p Length of Pipe *(Meter)*
- **P** Power *(Watt)*
- **R** Radius of pipe *(Meter)*
- **Re** Reynolds Number
- V_{max} Maximum Velocity *(Meter per Second)*
- V_{mean} Mean Velocity *(Meter per Second)*
- V_{shear} Shear Velocity *(Meter per Second)*
- **μ** Dynamic Viscosity *(Poise)*
- ρ_{Fluid} Density of Fluid *(Kilogram per Cubic Meter)*
- τ Shear Stress *(Pascal)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Power** in Watt (W)
  Power Unit Conversion
- Measurement: **Dynamic Viscosity** in Poise (P)
  Dynamic Viscosity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Pressure Gradient** in Newton per Cubic Meter (N/m³)
  Pressure Gradient Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- **Darcy Weisbach Equation Formulas**

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