Important Darcy Weisbach Equation Formulas PDF

Formulas
Examples
with Units

List of 26
Important Darcy Weisbach Equation Formulas

1) Area of Pipe given Total Required Power Formula

Evaluate Formula

Formula

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

Example with Units

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

2) Density of Fluid given Friction Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$1.2799\,kg/m^3 = 10.2\,P \cdot \frac{64}{5 \cdot 1.01\,m \cdot 10.1\,m/s}$$

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

Evaluate Formula

Formula

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

Example with Units

$$1.4602\,kg/m^3 = 8 \cdot \frac{93.1\,Pa}{5 \cdot 10.1\,m/s \cdot 10.1\,m/s}$$

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

Evaluate Formula

Formula

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

Example with Units

$$1.4602\,kg/m^3 = 8 \cdot \frac{93.1\,Pa}{5 \cdot \left(10.1\,m/s^2\right)}$$

5) Diameter of Pipe given Friction Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$1.0552\,m = \frac{64 \cdot 10.2\,P}{5 \cdot 10.1\,m/s \cdot 1.225\,kg/m^3}$$

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

Evaluate Formula

Formula

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

Example with Units

$$1.0402\,m = 5 \cdot 0.10\,m \cdot \frac{10.1\,m/s^2}{2 \cdot 9.8066\,m/s^2 \cdot 2.5\,m}$$

7) Dynamic Viscosity given Friction Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$9.7627\,\text{P} = \frac{5 \cdot 10.1\,\text{m/s} \cdot 1.01\,\text{m} \cdot 1.225\,\text{kg/m}^3}{64}$$

8) Head Loss due to Frictional Resistance Formula

Evaluate Formula

Formula

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

Example with Units

$$2.5748\,\text{m} = 5 \cdot 0.10\,\text{m} \cdot \frac{10.1\,\text{m/s}^2}{2 \cdot 9.8066\,\text{m/s}^2 \cdot 1.01\,\text{m}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$0.4903\,\text{m} = \frac{2.5\,\text{m} \cdot 2 \cdot 9.8066\,\text{m/s}^2 \cdot 1.01\,\text{m}}{5 \cdot 10.1\,\text{m/s} \cdot 2}$$

10) Pressure Gradient given Total Required Power Formula

Evaluate Formula

Formula

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

Example with Units

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

11) Reynolds Number given Friction Factor Formula

Evaluate Formula

Formula

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

Example

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

12) Shear Stress given Friction Factor and Density Formula

Evaluate Formula

Formula

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

Example with Units

$$78.1014\,\text{Pa} = 1.225\,\text{kg/m}^3 \cdot 5 \cdot 10.1\,\text{m/s} \cdot \frac{10.1\,\text{m/s}}{8}$$

13) Shear Velocity Formula

Evaluate Formula

Formula

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

Example with Units

$$7.9848\,\text{m/s} = 10.1\,\text{m/s} \cdot \sqrt{\frac{5}{8}}$$

14) Total Required Power Formula

Evaluate Formula

Formula

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

Example with Units

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

15) Friction Factor Formulas

15.1) Friction Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$5.224 = 64 \cdot \frac{10.2\,\text{P}}{1.225\,\text{kg/m}^3 \cdot 10.1\,\text{m/s} \cdot 1.01\,\text{m}}$$

15.2) Friction Factor given Reynolds Number Formula

Evaluate Formula

Formula

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

Example

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

15.3) Friction Factor given Shear Stress and Density Formula

Evaluate Formula

Formula

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

Example with Units

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

15.4) Friction Factor given Shear Velocity Formula

Evaluate Formula

Formula

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

Example with Units

$$6.3523 = 8 \cdot \left(\frac{9\,\text{m/s}}{10.1\,\text{m/s}}\right)^2$$

15.5) Friction Factor when Head Loss is due to Frictional Resistance Formula

Evaluate Formula

Formula

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

Example with Units

$$4.8548 = \frac{2.5\,\text{m} \cdot 2 \cdot 9.8066\,\text{m/s}^2 \cdot 1.01\,\text{m}}{0.10\,\text{m} \cdot 10.1\,\text{m/s}^2}$$

16) Mean Velocity of Flow Formulas

16.1) Mean Velocity of Flow given Friction Factor Formula

Evaluate Formula

Formula

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

Example with Units

$$10.5524\,\text{m/s} = \frac{64 \cdot 10.2\,\text{P}}{5 \cdot 1.225\,\text{kg/m}^3 \cdot 1.01\,\text{m}}$$

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

Evaluate Formula

Formula

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

Example with Units

$$9.9522\,\text{m/s} = \sqrt{\frac{2.5\,\text{m} \cdot 2 \cdot 9.8066\,\text{m/s}^2 \cdot 1.01\,\text{m}}{5 \cdot 0.10\,\text{m}}}$$

16.3) Mean Velocity of Flow given Maximum Velocity at Axis of Cylindrical Element Formula

Evaluate Formula

Formula

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

Example with Units

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

16.4) Mean Velocity of Flow given Shear Stress and Density Formula

Evaluate Formula

Formula

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

Example with Units

$$11.0272\,\text{m/s} = \sqrt{\frac{8 \cdot 93.1\,\text{Pa}}{1.225\,\text{kg/m}^3 \cdot 5}}$$

16.5) Mean Velocity of Flow given Shear Velocity Formula

Evaluate Formula

Formula

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

Example with Units

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

16.6) Mean Velocity of Flow given Total Required Power Formula

Evaluate Formula

Formula

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

Example with Units

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

16.7) Mean Velocity of Fluid Flow Formula

Evaluate Formula

Formula

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

Example with Units

$$8.3333\,\text{m/s} = \left(\frac{1}{8 \cdot 10.2\,\text{P}}\right) \cdot 17\,\text{N/m}^3 \cdot 2\,\text{m}^2$$

Variables used in list of Darcy Weisbach Equation Formulas above

- **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 in list of Darcy Weisbach Equation Formulas above

- constant(s): **[g]**, 9.80665
  Gravitational acceleration on Earth
- Functions: **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

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