Important Pipes Formulas PDF

Formulas
Examples
with Units

List of 12
Important Pipes Formulas

1) Barlow's Formula for Pipe Formula

Evaluate Formula

Formula

$$P = \frac{2 \cdot \sigma \cdot t}{D_o}$$

Example with Units

$$24351.3\,\text{Pa} = \frac{2 \cdot 93.3\,\text{Pa} \cdot 7.83\,\text{m}}{0.06\,\text{m}}$$

2) Coefficient of Discharge at Venacontracta of Orifice Formula

Evaluate Formula

Formula

$$C_d = C_c \cdot C_v$$

Example

$$0.315 = 15 \cdot 0.021$$

3) Depth of Centroid given Total Hydrostatic Force Formula

Evaluate Formula

Formula

$$h_G = \frac{F_{hs}}{\gamma_1 \cdot SA_{Wetted}}$$

Example with Units

$$0.0124\,\text{m} = \frac{121\,\text{N}}{1342\,\text{N/m}^3 \cdot 7.3\,\text{m}^2}$$

4) Diameter of Pipe given Head Loss due to Laminar Flow Formula

Evaluate Formula

Formula

$$D_{pipe} = \left(\frac{128 \cdot \mu \cdot Q \cdot s}{\gamma \cdot \pi \cdot h_f}\right)^{\frac{1}{4}}$$

Example with Units

$$1.0249\,\text{m} = \left(\frac{128 \cdot 94.18672\,\text{N} \cdot 13.5\,\text{m}^3\text{/s} \cdot 0.002232\,\text{m}}{87.32\,\text{N/m}^3 \cdot 3.1416 \cdot 1.2\,\text{m}}\right)^{\frac{1}{4}}$$

5) Frictional Factor of Laminar flow Formula

Evaluate Formula

Formula

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

Example

$$0.0128 = \frac{64}{5000}$$

6) Head Loss due to Laminar Flow Formula

Evaluate Formula

Formula

$$h_f = \frac{128 \cdot \mu \cdot Q \cdot s}{\pi \cdot \gamma \cdot d_{pipe}^{\,4}}$$

Example with Units

$$1.2\,\text{m} = \frac{128 \cdot 94.18672\,\text{N} \cdot 13.5\,\text{m}^3\text{/s} \cdot 0.002232\,\text{m}}{3.1416 \cdot 92.6\,\text{N/m}^3 \cdot 1.01\,\text{m}^4}$$

7) Head Loss using Efficiency of Hydraulic Transmission Formula

Evaluate Formula

Formula

$$h_f = H_{ent} - \eta \cdot H_{ent}$$

Example with Units

$$1.2\,\text{m} = 6\,\text{m} - 0.80 \cdot 6\,\text{m}$$

8) Heat Loss due to Pipe Formula

Evaluate Formula

Formula

$$Qpipeloss = \frac{F_{viscous} \cdot L_{pipe} \cdot u_{Fluid}^2}{2 \cdot d \cdot g}$$

Example with Units

$$4.8335\,\text{J} = \frac{2.5\,\text{N} \cdot 3\,\text{m} \cdot 12\,\text{m/s}^2}{2 \cdot 11.4\,\text{m} \cdot 9.8\,\text{m/s}^2}$$

9) Length of Pipe given Head loss Formula

Evaluate Formula

Formula

$$s = h_f \cdot \gamma \cdot \pi \cdot \frac{d_{pipe}^4}{128 \cdot Q \cdot \mu}$$

Example with Units

$$0.0022\,\text{m} = 1.2\,\text{m} \cdot 92.6\,\text{N/m}^3 \cdot 3.1416 \cdot \frac{1.01\,\text{m}^4}{128 \cdot 13.5\,\text{m}^3\text{/s} \cdot 94.18672\,\text{N}}$$

10) Viscous Force Per Unit Area Formula

Evaluate Formula

Formula

$$F_v = \frac{F_{viscous}}{A}$$

Example with Units

$$0.05\,\text{Pa} = \frac{2.5\,\text{N}}{50\,\text{m}^2}$$

11) Viscous Force using Head loss Due to Laminar Flow Formula

Evaluate Formula

Formula

$$\mu = h_f \cdot \gamma \cdot \pi \cdot \frac{d_{pipe}^4}{128 \cdot Q \cdot s}$$

Example with Units

$$94.1867\,\text{N} = 1.2\,\text{m} \cdot 92.6\,\text{N/m}^3 \cdot 3.1416 \cdot \frac{1.01\,\text{m}^4}{128 \cdot 13.5\,\text{m}^3\text{/s} \cdot 0.002232\,\text{m}}$$

12) Viscous Stress Formula

Evaluate Formula

Formula

$$V_s = \mu_{viscosity} \cdot \frac{VG}{DL}$$

Example with Units

$$3.8202\,\text{N} = 10.2\,\text{P} \cdot \frac{20\,\text{m/s}}{5.34\,\text{m}}$$

Variables used in list of Pipes Formulas above

- **A** Area *(Square Meter)*
- C_c Coefficient of Contraction
- C_d Coefficient of Discharge
- C_v Coefficient of Velocity
- **d** Diameter *(Meter)*
- D_o Outside Diameter *(Meter)*
- d_{pipe} Pipe Diameter *(Meter)*
- D_{pipe} Diameter of Pipe *(Meter)*
- **DL** Fluid Thickness *(Meter)*
- **f** Friction Factor
- F_{hs} Hydrostatic Force *(Newton)*
- F_v Viscous Force *(Pascal)*
- $F_{viscous}$ Force *(Newton)*
- **g** Acceleration Due To Gravity *(Meter per Square Second)*
- H_{ent} Total Head at Entrance *(Meter)*
- h_f Head loss *(Meter)*
- h_G Depth of Centroid *(Meter)*
- L_{pipe} Length *(Meter)*
- **P** Pressure *(Pascal)*
- **Q** Rate of Flow *(Cubic Meter per Second)*
- **Qpipeloss** Heat Loss due to Pipe *(Joule)*
- **Re** Reynolds Number
- **s** Change in Drawdown *(Meter)*
- SA_{Wetted} Surface Area *(Square Meter)*
- **t** Wall Thickness *(Meter)*
- u_{Fluid} Fluid Velocity *(Meter per Second)*
- V_s Viscous Stress *(Newton)*
- **VG** Velocity Gradient *(Meter per Second)*
- **y** Specific Weight of Liquid *(Newton per Cubic Meter)*
- **γ** Specific Weight *(Newton per Cubic Meter)*
- γ_1 Specific Weight 1 *(Newton per Cubic Meter)*

Constants, Functions, Measurements used in list of Pipes Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Pressure** in Pascal (Pa)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Energy** in Joule (J)
  Energy Unit Conversion
- Measurement: **Force** in Newton (N)
  Force Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Dynamic Viscosity** in Poise (P)
  Dynamic Viscosity Unit Conversion
- Measurement: **Specific Weight** in Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion

- η Efficiency
- μ Viscous Force head loss *(Newton)*
- $\mu_{viscosity}$ Dynamic Viscosity *(Poise)*
- σ Applied Stress *(Pascal)*

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