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Flow of Liquids inside Packed Beds Formulas

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List of 12 Flow of Liquids inside Packed Beds Formulas

Flow of Liquids inside Packed Beds

1) Absolute Viscosity of Fluid by Ergun

Open Calculator

$$\mu = \frac{D_o \cdot U_b \cdot \rho}{Re_{pb} \cdot (1 - \in)}$$

$$24.925\text{Pa*s} = \frac{25\text{m} \cdot 0.05\text{m/s} \cdot 997\text{kg/m}^3}{200 \cdot (1 - 0.75)}$$

2) Density of Fluid by Ergun

Open Calculator

$$\rho = \frac{Re_{pb} \cdot \mu \cdot (1 - \in)}{D_{eff} \cdot U_b}$$

$$997.399\text{kg/m}^3 = \frac{200 \cdot 24.925\text{Pa*s} \cdot (1 - 0.75)}{24.99\text{m} \cdot 0.05\text{m/s}}$$

3) Effective Particle Diameter by Ergun given Frication Factor

Open Calculator

$$D_{eff} = \frac{f_f \cdot L_b \cdot U_b^2 \cdot (1 - \in)}{g \cdot H_f \cdot \in^3}$$

$$24.79214\text{m} = \frac{1.148 \cdot 1100\text{m} \cdot (0.05\text{m/s})^2 \cdot (1 - 0.75)}{9.8\text{m/s}^2 \cdot 0.0077\text{m} \cdot (0.75)^3}$$

4) Effective Particle Diameter by Ergun given Reynolds Number

Open Calculator

fx $$D_{eff} = \frac{Re_{pb} \cdot \mu \cdot (1 - \in)}{U_b \cdot \rho}$$

ex $$25m = \frac{200 \cdot 24.925Pa*s \cdot (1 - 0.75)}{0.05m/s \cdot 997kg/m^3}$$

5) Friction Factor by Beek

Open Calculator

fx $$f_f = \frac{1 - \in}{\in^3} \cdot \left(1.75 + 150 \cdot \left(\frac{1 - \in}{Re_{pb}}\right)\right)$$

ex $$1.148148 = \frac{1 - 0.75}{(0.75)^3} \cdot \left(1.75 + 150 \cdot \left(\frac{1 - 0.75}{200}\right)\right)$$

6) Friction Factor by Ergun

Open Calculator

fx $$f_f = \frac{g \cdot D_{eff} \cdot H_f \cdot \in^3}{L_b \cdot U_b^2 \cdot (1 - \in)}$$

ex $$1.157162 = \frac{9.8m/s^2 \cdot 24.99m \cdot 0.0077m \cdot (0.75)^3}{1100m \cdot (0.05m/s)^2 \cdot (1 - 0.75)}$$

7) Friction Factor by Ergun for Rep Value between 1 and 2500

Open Calculator

fx $$f_f = \frac{150}{Re_{pb}} + 1.75$$

ex $$2.5 = \frac{150}{200} + 1.75$$

8) Friction Factor by Kozeny-Carman

Open Calculator

fx $$f_f = \frac{150}{Re_{pb}}$$

ex $$0.75 = \frac{150}{200}$$

9) Head of Fluid Lost Due to Friction

Open Calculator

fx $$H_f = \frac{f_f \cdot L_b \cdot U_b^2 \cdot (1 - \in)}{g \cdot D_{eff} \cdot \in^3}$$

ex $$0.007639\text{m} = \frac{1.148 \cdot 1100\text{m} \cdot (0.05\text{m/s})^2 \cdot (1 - 0.75)}{9.8\text{m/s}^2 \cdot 24.99\text{m} \cdot (0.75)^3}$$

10) Mean Effective Diameter

Open Calculator

fx $$D_o = \frac{6}{S_{vm}}$$

ex $$25\text{m} = \frac{6}{0.24}$$

11) Reynolds Number of Packed Beds by Ergun

Open Calculator

fx $$\mathrm{Re_{pb}} = \frac{\mathrm{D_{eff}} \cdot \mathrm{U_b} \cdot \rho}{\mu \cdot (1 - \in)}$$

ex $$199.92 = \frac{24.99\mathrm{m} \cdot 0.05\mathrm{m/s} \cdot 997\mathrm{kg/m^3}}{24.925\mathrm{Pa*s} \cdot (1 - 0.75)}$$

12) Superficial Velocity by Ergun given Reynolds Number

Open Calculator

fx $$\mathrm{U_b} = \frac{\mathrm{Re_{pb}} \cdot \mu \cdot (1 - \in)}{\mathrm{D_{eff}} \cdot \rho}$$

ex $$0.05002\mathrm{m/s} = \frac{200 \cdot 24.925\mathrm{Pa*s} \cdot (1 - 0.75)}{24.99\mathrm{m} \cdot 997\mathrm{kg/m^3}}$$

Variables Used

- $\in$ Void Fraction
- D_{eff} Diameter(eff) *(Meter)*
- D_o Diameter of Object *(Meter)*
- f_f Factor of Friction
- g Acceleration due to Gravity *(Meter per Square Second)*
- H_f Head of Fluid *(Meter)*
- L_b Length of Packaged Bed *(Meter)*
- Re_{pb} Reynolds Number(pb)
- S_{vm} Mean Specific Surface
- U_b Superficial Velocity *(Meter per Second)*
- μ Absolute Viscosity *(Pascal Second)*
- ρ Density *(Kilogram per Cubic Meter)*

Constants, Functions, Measurements used

- Measurement: **Length** in Meter (m)
  Length 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: **Dynamic Viscosity** in Pascal Second (Pa*s)
  Dynamic Viscosity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion

Check other formula lists

- **Flow of Liquids inside Packed Beds Formulas**

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