Important Laminar Flow between Parallel Plates, both plates at rest Formulas PDF

Formulas Examples with Units

List of 30 Important Laminar Flow between Parallel Plates, both plates at rest Formulas

1) Discharge given Mean Velocity of Flow Formula

Evaluate Formula

Formula

$$Q = w \cdot V_{mean}$$

Example with Units

$$97.2\,\text{m}^3/\text{s} = 3\,\text{m} \cdot 32.4\,\text{m/s}$$

2) Discharge given Viscosity Formula

Evaluate Formula

Formula

$$Q = dp|dr \cdot \frac{w^3}{12 \cdot \mu}$$

Example with Units

$$37.5\,\text{m}^3/\text{s} = 17\,\text{N/m}^3 \cdot \frac{3\,\text{m}^3}{12 \cdot 10.2\,\text{P}}$$

3) Distance between Plates given Discharge Formula

Evaluate Formula

Formula

$$w = \left(\frac{Q \cdot 12 \cdot \mu}{dp|dr}\right)^{\frac{1}{3}}$$

Example with Units

$$3.4085\,\text{m} = \left(\frac{55\,\text{m}^3/\text{s} \cdot 12 \cdot 10.2\,\text{P}}{17\,\text{N/m}^3}\right)^{\frac{1}{3}}$$

4) Distance between Plates given Maximum Velocity between Plates Formula

Evaluate Formula

Formula

$$w = \sqrt{\frac{8 \cdot \mu \cdot V_{max}}{dp|dr}}$$

Example with Units

$$2.988\,\text{m} = \sqrt{\frac{8 \cdot 10.2\,\text{P} \cdot 18.6\,\text{m/s}}{17\,\text{N/m}^3}}$$

5) Distance between Plates given Mean Velocity of Flow Formula

Evaluate Formula

Formula

$$w = \frac{Q}{V_{mean}}$$

Example with Units

$$1.6975\,\text{m} = \frac{55\,\text{m}^3/\text{s}}{32.4\,\text{m/s}}$$

6) Distance between Plates given Mean Velocity of Flow with Pressure Gradient Formula

Evaluate Formula

Formula

$$w = \sqrt{\frac{12 \cdot \mu \cdot V_{mean}}{dp|dr}}$$

Example with Units

$$4.8299\,\text{m} = \sqrt{\frac{12 \cdot 10.2\,\text{P} \cdot 32.4\,\text{m/s}}{17\,\text{N/m}^3}}$$

7) Distance between Plates given Pressure Difference Formula

Evaluate Formula

Formula

$$w = \sqrt{12 \cdot V_{mean} \cdot \mu \cdot \frac{L_p}{\Delta P}}$$

Example with Units

$$1.7268\,\text{m} = \sqrt{12 \cdot 32.4\,\text{m/s} \cdot 10.2\,\text{P} \cdot \frac{0.10\,\text{m}}{13.3\,\text{N/m}^2}}$$

8) Distance between Plates given Pressure Head Drop Formula

Evaluate Formula

Formula

$$w = \sqrt{\frac{12 \cdot \mu \cdot L_p \cdot V_{mean}}{\gamma_f \cdot h_{location}}}$$

Example with Units

$$1.4587\,\text{m} = \sqrt{\frac{12 \cdot 10.2\,\text{P} \cdot 0.10\,\text{m} \cdot 32.4\,\text{m/s}}{9.81\,\text{kN/m}^3 \cdot 1.9\,\text{m}}}$$

9) Distance between Plates given Shear Stress Distribution Profile Formula

Evaluate Formula

Formula

$$w = 2 \cdot \left(R - \left(\frac{\tau}{dp|dr}\right)\right)$$

Example with Units

$$2.8471\,\text{m} = 2 \cdot \left(6.9\,\text{m} - \left(\frac{93.1\,\text{Pa}}{17\,\text{N/m}^3}\right)\right)$$

10) Distance between Plates using Velocity Distribution Profile Formula

Evaluate Formula

Formula

$$w = \frac{\left(\frac{-v \cdot 2 \cdot \mu}{dp|dr}\right) + \left(R^2\right)}{R}$$

Example with Units

$$5.8292\,\text{m} = \frac{\left(\frac{-61.57\,\text{m/s} \cdot 2 \cdot 10.2\,\text{P}}{17\,\text{N/m}^3}\right) + \left(6.9\,\text{m}^2\right)}{6.9\,\text{m}}$$

11) Horizontal Distance given Shear Stress Distribution Profile Formula

Evaluate Formula

Formula

$$R = \frac{w}{2} + \left(\frac{\tau}{dp|dr}\right)$$

Example with Units

$$6.9765\,\text{m} = \frac{3\,\text{m}}{2} + \left(\frac{93.1\,\text{Pa}}{17\,\text{N/m}^3}\right)$$

12) Length of Pipe given Pressure Difference Formula

Evaluate Formula

Formula

$$L_p = \frac{\Delta P \cdot w \cdot w}{\mu \cdot 12 \cdot V_{mean}}$$

Example with Units

$$0.3018\,\text{m} = \frac{13.3\,\text{N/m}^2 \cdot 3\,\text{m} \cdot 3\,\text{m}}{10.2\,\text{P} \cdot 12 \cdot 32.4\,\text{m/s}}$$

13) Length of Pipe given Pressure Head Drop Formula

Evaluate Formula

Formula

$$L_p = \frac{\gamma_f \cdot w \cdot w \cdot h_{location}}{12 \cdot \mu \cdot V_{mean}}$$

Example with Units

$$0.423\,\text{m} = \frac{9.81\,\text{kN/m}^3 \cdot 3\,\text{m} \cdot 3\,\text{m} \cdot 1.9\,\text{m}}{12 \cdot 10.2\,\text{P} \cdot 32.4\,\text{m/s}}$$

14) Maximum Shear Stress in fluid Formula

Evaluate Formula

Formula

$$\tau_{smax} = 0.5 \cdot dp|dr \cdot w$$

Example with Units

$$25.5\,\mathrm{N/mm^2} = 0.5 \cdot 17\,\mathrm{N/m^3} \cdot 3\,\mathrm{m}$$

15) Maximum Velocity between Plates Formula

Evaluate Formula

Formula

$$V_{max} = \frac{\left(w^2\right) \cdot dp|dr}{8 \cdot \mu}$$

Example with Units

$$18.75\,\mathrm{m/s} = \frac{\left(3\,\mathrm{m}^2\right) \cdot 17\,\mathrm{N/m^3}}{8 \cdot 10.2\,\mathrm{P}}$$

16) Maximum Velocity given Mean Velocity of Flow Formula

Evaluate Formula

Formula

$$V_{max} = 1.5 \cdot V_{mean}$$

Example with Units

$$48.6\,\mathrm{m/s} = 1.5 \cdot 32.4\,\mathrm{m/s}$$

17) Pressure Difference Formula

Evaluate Formula

Formula

$$\Delta P = 12 \cdot \mu \cdot V_{mean} \cdot \frac{L_p}{w^2}$$

Example with Units

$$4.4064\,\mathrm{N/m^2} = 12 \cdot 10.2\,\mathrm{P} \cdot 32.4\,\mathrm{m/s} \cdot \frac{0.10\,\mathrm{m}}{3\,\mathrm{m}^2}$$

18) Pressure Head Drop Formula

Evaluate Formula

Formula

$$h_{location} = \frac{12 \cdot \mu \cdot L_p \cdot V_{mean}}{\gamma_f}$$

Example with Units

$$4.0426\,\mathrm{m} = \frac{12 \cdot 10.2\,\mathrm{P} \cdot 0.10\,\mathrm{m} \cdot 32.4\,\mathrm{m/s}}{9.81\,\mathrm{kN/m^3}}$$

19) Shear Stress Distribution Profile Formula

Evaluate Formula

Formula

$$\tau = -\, dp|dr \cdot \left(\frac{w}{2} - R\right)$$

Example with Units

$$91.8\,\mathrm{Pa} = -\, 17\,\mathrm{N/m^3} \cdot \left(\frac{3\,\mathrm{m}}{2} - 6.9\,\mathrm{m}\right)$$

20) Velocity Distribution Profile Formula

Evaluate Formula

Formula

$$v = -\left(\frac{1}{2 \cdot \mu}\right) \cdot dp|dr \cdot \left(w \cdot R - \left(R^2\right)\right)$$

Example with Units

$$224.25\,\mathrm{m/s} = -\left(\frac{1}{2 \cdot 10.2\,\mathrm{P}}\right) \cdot 17\,\mathrm{N/m^3} \cdot \left(3\,\mathrm{m} \cdot 6.9\,\mathrm{m} - \left(6.9\,\mathrm{m}^2\right)\right)$$

21) Mean Velocity of Flow Formulas

21.1) Mean Velocity of Flow given Maximum Velocity Formula

Evaluate Formula

Formula

$$V_{mean} = \left(\frac{2}{3}\right) \cdot V_{max}$$

Example with Units

$$12.4\,\mathrm{m/s} = \left(\frac{2}{3}\right) \cdot 18.6\,\mathrm{m/s}$$

21.2) Mean Velocity of Flow given Pressure Difference Formula

Evaluate Formula

Formula

$$V_{mean} = \frac{\Delta P \cdot w}{12 \cdot \mu \cdot L_p}$$

Example with Units

$$32.598\,\mathrm{m/s} = \frac{13.3\,\mathrm{N/m^2} \cdot 3\,\mathrm{m}}{12 \cdot 10.2\,\mathrm{P} \cdot 0.10\,\mathrm{m}}$$

21.3) Mean Velocity of Flow given Pressure Gradient Formula

Evaluate Formula

Formula

$$V_{mean} = \left(\frac{w^2}{12 \cdot \mu}\right) \cdot dp|dr$$

Example with Units

$$12.5\,\mathrm{m/s} = \left(\frac{3\,\mathrm{m}^2}{12 \cdot 10.2\,\mathrm{P}}\right) \cdot 17\,\mathrm{N/m^3}$$

21.4) Mean Velocity of Flow given Pressure Head Drop Formula

Evaluate Formula

Formula

$$V_{mean} = \frac{\Delta P \cdot S \cdot \left(D_{pipe}^2\right)}{12 \cdot \mu \cdot L_p}$$

Example with Units

$$8.3133\,\mathrm{m/s} = \frac{13.3\,\mathrm{N/m^2} \cdot 0.75\,\mathrm{kN/m^3} \cdot \left(1.01\,\mathrm{m}^2\right)}{12 \cdot 10.2\,\mathrm{P} \cdot 0.10\,\mathrm{m}}$$

22) Pressure Gradient Formulas

22.1) Pressure Gradient given Maximum Velocity between Plates Formula

Evaluate Formula

Formula

$$dp|dr = \frac{V_{max} \cdot 8 \cdot \mu}{w^2}$$

Example with Units

$$16.864\,\mathrm{N/m^3} = \frac{18.6\,\mathrm{m/s} \cdot 8 \cdot 10.2\,\mathrm{P}}{3\,\mathrm{m}^2}$$

22.2) Pressure Gradient given Shear Stress Distribution Profile Formula

Evaluate Formula

Formula

$$dp|dr = -\frac{\tau}{\frac{w}{2} - R}$$

Example with Units

$$17.2407\,\mathrm{N/m^3} = -\frac{93.1\,\mathrm{Pa}}{\frac{3\,\mathrm{m}}{2} - 6.9\,\mathrm{m}}$$

23) Dynamic Viscosity Formulas

23.1) Dynamic Viscosity given Maximum Velocity between Plates Formula

Evaluate Formula

Formula

$$\mu = \frac{\left(w^2\right) \cdot dp|dr}{8 \cdot V_{max}}$$

Example with Units

$$10.2823\,\text{P} = \frac{\left(3\,\text{m}^2\right) \cdot 17\,\text{N/m}^3}{8 \cdot 18.6\,\text{m/s}}$$

23.2) Dynamic Viscosity given Mean Velocity of Flow with Pressure Gradient Formula

Evaluate Formula

Formula

$$\mu = \left(\frac{w^2}{12 \cdot V_{mean}}\right) \cdot dp|dr$$

Example with Units

$$3.9352\,\text{P} = \left(\frac{3\,\text{m}^2}{12 \cdot 32.4\,\text{m/s}}\right) \cdot 17\,\text{N/m}^3$$

23.3) Dynamic Viscosity given Pressure Difference Formula

Evaluate Formula

Formula

$$\mu = \frac{\Delta P \cdot w}{12 \cdot V_{mean} \cdot L_p}$$

Example with Units

$$10.2623\,\text{P} = \frac{13.3\,\text{N/m}^2 \cdot 3\,\text{m}}{12 \cdot 32.4\,\text{m/s} \cdot 0.10\,\text{m}}$$

23.4) Dynamic Viscosity using Velocity Distribution Profile Formula

Evaluate Formula

Formula

$$\mu = \left(\frac{1}{2 \cdot v}\right) \cdot dp|dr \cdot \left(w \cdot R^2\right)$$

Example with Units

$$197.1829\,\text{P} = \left(\frac{1}{2 \cdot 61.57\,\text{m/s}}\right) \cdot 17\,\text{N/m}^3 \cdot \left(3\,\text{m} \cdot 6.9\,\text{m}^2\right)$$

Variables used in list of Laminar Flow between Parallel Plates, both plates at rest Formulas above

- D_{pipe} Diameter of Pipe *(Meter)*
- **dp|dr** Pressure Gradient *(Newton per Cubic Meter)*
- $h_{location}$ Head Loss due to Friction *(Meter)*
- L_p Length of Pipe *(Meter)*
- **Q** Discharge in Laminar Flow *(Cubic Meter per Second)*
- **R** Horizontal Distance *(Meter)*
- **S** Specific Weight of Liquid in Piezometer *(Kilonewton per Cubic Meter)*
- **v** Velocity of Liquid *(Meter per Second)*
- V_{max} Maximum Velocity *(Meter per Second)*
- V_{mean} Mean Velocity *(Meter per Second)*
- **w** Width *(Meter)*
- γ_f Specific Weight of Liquid *(Kilonewton per Cubic Meter)*
- **ΔP** Pressure Difference *(Newton per Square Meter)*
- **μ** Dynamic Viscosity *(Poise)*
- τ_{smax} Maximum Shear Stress in Shaft *(Newton per Square Millimeter)*
- τ Shear Stress *(Pascal)*

Constants, Functions, Measurements used in list of Laminar Flow between Parallel Plates, both plates at rest Formulas above

- 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: **Pressure** in Newton per Square Meter (N/m²)
  Pressure Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed 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 Kilonewton per Cubic Meter (kN/m³)
  Specific Weight Unit Conversion
- Measurement: **Pressure Gradient** in Newton per Cubic Meter (N/m³)
  Pressure Gradient Unit Conversion
- Measurement: **Stress** in Pascal (Pa), Newton per Square Millimeter (N/mm²)
  Stress Unit Conversion

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