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

Example with Units

 $Q = w \cdot V_{\text{mean}} \qquad 97.2 \, \text{m}^{3/\text{s}} = 3 \, \text{m} \cdot 32.4 \, \text{m/s}$

Evaluate Formula (

Evaluate Formula [

Evaluate Formula (

2) Discharge given Viscosity Formula C

 $Q = dp|dr \cdot \frac{w^{3}}{12 \cdot \mu} \qquad 37.5 \, m^{3}/s = 17 \, N/m^{3} \cdot \frac{3 \, m^{3}}{12 \cdot 10.2 \, P}$

3) Distance between Plates given Discharge Formula C

Formula

Example with Units $w = \left(\frac{Q \cdot 12 \cdot \mu}{dp | dr}\right)^{\frac{1}{3}}$ 3.4085 m = $\left(\frac{55 \,\mathrm{m}^3/\mathrm{s} \cdot 12 \cdot 10.2 \,\mathrm{p}}{17 \,\mathrm{N/m}^3}\right)^{\frac{1}{3}}$

4) Distance between Plates given Maximum Velocity between Plates Formula 🗂 Evaluate Formula (

 $w = \sqrt{\frac{8 \cdot \mu \cdot V_{max}}{dp | dr}} \quad \boxed{ 2.988_m = \sqrt{\frac{8 \cdot 10.2_P \cdot 18.6_{m/s}}{17_{N/m^3}}} }$

5) Distance between Plates given Mean Velocity of Flow Formula C

 $w = \frac{Q}{V_{\text{mean}}} \left[1.6975 \,\text{m} = \frac{55 \,\text{m}^3/\text{s}}{32.4 \,\text{m/s}} \right]$

Evaluate Formula (

Evaluate Formula 🕝

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

Example with Units $w = \sqrt{\frac{12 \cdot \mu \cdot V_{mean}}{dp|dr}} \qquad 4.8299 \,_{m} = \sqrt{\frac{12 \cdot 10.2 \,_{P} \cdot 32.4 \,_{m/s}}{17 \,_{N/m^{3}}}}$

7) Distance between Plates given Pressure Difference Formula 🕝



Example with Units

Evaluate Formula (

Evaluate Formula (

Evaluate Formula

Evaluate Formula [

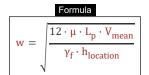
Evaluate Formula

Evaluate Formula (

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

$$w = \sqrt{12 \cdot V_{mean} \cdot \mu \cdot \frac{L_p}{\Delta P}} \quad \boxed{ 1.7268 \, \text{m} \, = \, \sqrt{12 \cdot 32.4 \, \text{m/s} \, \cdot 10.2 \, \text{P} \, \cdot \frac{0.10 \, \text{m}}{13.3 \, \text{N/m}^2}} }$$

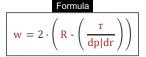
8) Distance between Plates given Pressure Head Drop Formula 🕝



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

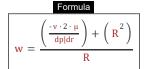
$$1.4587 \, \text{m} = \sqrt{\frac{12 \cdot 10.2 \, \text{p} \cdot 0.10 \, \text{m} \cdot 32.4 \, \text{m/s}}{9.81 \, \text{kN/m}^3 \cdot 1.9 \, \text{m}}}$$

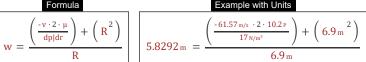
9) Distance between Plates given Shear Stress Distribution Profile Formula 🕝



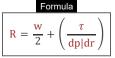
Formula Example with Units
$$w = 2 \cdot \left(R - \left(\frac{\tau}{dp|dr}\right)\right) \qquad 2.8471_{m} = 2 \cdot \left(6.9_{m} - \left(\frac{93.1_{Pa}}{17_{N/m^{3}}}\right)\right)$$

10) Distance between Plates using Velocity Distribution Profile Formula 🕝





11) Horizontal Distance given Shear Stress Distribution Profile Formula 🕝



Formula Example with Units
$$R = \frac{w}{2} + \left(\frac{\tau}{dp|dr}\right) = 6.9765 \, \text{m} = \frac{3 \, \text{m}}{2} + \left(\frac{93.1 \, \text{Pa}}{17 \, \text{N/m}^3}\right)$$

12) Length of Pipe given Pressure Difference Formula C

$$L_{p} = \frac{\Delta P \cdot w \cdot w}{\mu \cdot 12 \cdot V_{mean}} \qquad 0.3018_{m} = \frac{13.3 \, \text{N/m}^{2} \cdot 3_{m} \cdot 3_{m}}{10.2 \, \text{P} \cdot 12 \cdot 32.4_{m/s}}$$

13) Length of Pipe given Pressure Head Drop Formula C

 $L_{p} = \frac{\gamma_{f} \cdot w \cdot w \cdot h_{location}}{12 \cdot u \cdot V_{max}}$

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



Formula

Example with Units

Evaluate Formula (

Evaluate Formula (

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

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

15) Maximum Velocity between Plates Formula [7]

Formula

 $V_{\text{max}} = \frac{\left(w^2\right) \cdot dp | dr}{8 \cdot u} \bigg| 18.75 \,\text{m/s} = \frac{\left(3 \,\text{m}^2\right) \cdot 17 \,\text{N/m}^3}{8 \cdot 10.2 \,\text{p}}$

16) Maximum Velocity given Mean Velocity of Flow Formula 🕝

Formula

Example with Units $V_{\text{max}} = 1.5 \cdot V_{\text{mean}}$ $48.6 \, \text{m/s} = 1.5 \cdot 32.4 \, \text{m/s}$ Evaluate Formula

17) Pressure Difference Formula 🕝

Formula $\Delta P = 12 \cdot \mu \cdot V_{\text{mean}} \cdot \frac{L_{\text{p}}}{V_{\text{mean}}^2} = 12 \cdot 10.2 \, \text{p} \cdot 32.4 \, \text{m/s} \cdot \frac{0.10 \, \text{m}}{3 \, \text{m}^2}$

Example with Units

Evaluate Formula

18) Pressure Head Drop Formula C

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

Example with Units

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

19) Shear Stress Distribution Profile Formula 🕝

Formula $\tau = -\operatorname{dp} \left| \operatorname{dr} \cdot \left(\frac{\operatorname{w}}{2} - \operatorname{R} \right) \right| \quad \left| 91.8 \, \operatorname{Pa} \right| = -17 \, \operatorname{N/m}^3 \cdot \left(\frac{3 \, \mathrm{m}}{2} - 6.9 \, \mathrm{m} \right)$

Example with Units

Evaluate Formula C

Evaluate Formula

Evaluate Formula (

20) Velocity Distribution Profile Formula 🕝

 $\mathbf{v} = -\left(\frac{1}{2 \cdot \mu}\right) \cdot d\mathbf{p} | d\mathbf{r} \cdot \left(\mathbf{w} \cdot \mathbf{R} - \left(\mathbf{R}^2\right)\right)$

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

21) Mean Velocity of Flow Formulas (7)

21.1) Mean Velocity of Flow given Maximum Velocity Formula 🕝

Formula

Example with Units $V_{\text{mean}} = \left(\frac{2}{3}\right) \cdot V_{\text{max}}$ | $12.4 \,\text{m/s} = \left(\frac{2}{3}\right) \cdot 18.6 \,\text{m/s}$ Evaluate Formula

Evaluate Formula [

Evaluate Formula (

Evaluate Formula (

Evaluate Formula C

21.2) Mean Velocity of Flow given Pressure Difference Formula C

Formula

Example with Units $V_{mean} = \frac{\Delta P \cdot w}{12 \cdot \mu \cdot L_p} \quad | \quad 32.598 \text{m/s} = \frac{13.3 \text{ N/m}^2 \cdot 3 \text{ m}}{12 \cdot 10.2 \text{ P} \cdot 0.10 \text{ m}}$

21.3) Mean Velocity of Flow given Pressure Gradient Formula [7]

Example with Units

 $V_{mean} = \left(\frac{w^2}{12 \cdot \mu}\right) \cdot dp |dr| \left| 12.5 \, m/s \right| = \left(\frac{3 \, m^2}{12 \cdot 10.2 \, P}\right) \cdot 17 \, N/m^3$

21.4) Mean Velocity of Flow given Pressure Head Drop Formula 🕝

Example with Units

 $V_{mean} = \frac{\Delta P \cdot S \cdot \left(\ D_{pipe}^{\ 2} \right)}{12 \cdot \mu \cdot L_{p}} \ \left| \ \ 8.3133 \, \text{m/s} \ = \frac{13.3 \, \text{N/m}^{2} \cdot 0.75 \, \text{kN/m}^{3} \cdot \left(\ 1.01 \, \text{m}^{\ 2} \right)}{12 \cdot 10.2 \, \text{p} \cdot 0.10 \, \text{m}} \right|$

22) Pressure Gradient Formulas

22.1) Pressure Gradient given Maximum Velocity between Plates Formula C

Example with Units $dp|dr = \frac{V_{\text{max}} \cdot 8 \cdot \mu}{2} \qquad 16.864 \, \text{N/m}^3 = \frac{18.6 \, \text{m/s} \cdot 8 \cdot 10.2 \, \text{P}}{2 \, \text{m/s}^2}$

22.2) Pressure Gradient given Shear Stress Distribution Profile Formula C

Evaluate Formula

 $dp|dr = -\frac{\tau}{\frac{w}{2} - R} = 17.2407 \text{ N/m}^3 = -\frac{93.1 \text{ Pa}}{\frac{3 \text{ m}}{2} - 6.9 \text{ m}}$

23) Dynamic Viscosity Formulas (7)

23.1) Dynamic Viscosity given Maximum Velocity between Plates Formula 🗗



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

Example with Units

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

Evaluate Formula 🕝

Evaluate Formula 🕝

Evaluate Formula (

Evaluate Formula 🕝

Formula

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

$$\mu = \left(\frac{w^2}{12 \cdot V_{mean}}\right) \cdot dp | dr \qquad 3.9352 P = \left(\frac{3 m^2}{12 \cdot 32.4 m/s}\right) \cdot 17 N/m^3$$

23.3) Dynamic Viscosity given Pressure Difference Formula C

Formula

$$\mu = \frac{\Delta P \cdot w}{12 \cdot V_{\text{mean}} \cdot L_{\text{p}}}$$

Example with Units

23.4) Dynamic Viscosity using Velocity Distribution Profile Formula C

Formula

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

Example with Units

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

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

- Dpipe 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)
- Y_f Specific Weight of Liquid (Kilonewton per Cubic Meter)
- ΔP Pressure Difference (Newton per Square Meter)
- µ Dynamic Viscosity (Poise)
- T_{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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HCF of two numbers

• 🌆 Improper fraction 🕝

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