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Turbulent Flow Formulas

Calculators! Examples! Conversions!

List of 18 Turbulent Flow Formulas

Turbulent Flow

1) Average Height of Irregularities for Turbulent Flow in Pipes

Open Calculator

fx $$k = \frac{v \cdot Re}{V*}$$

ex $$0.001208m = \frac{7.25St \cdot 10}{6m/s}$$

2) Blasius Equation

Open Calculator

fx $$f = \frac{0.316}{Re^{\frac{1}{4}}}$$

ex $$0.1777 = \frac{0.316}{(10)^{\frac{1}{4}}}$$

3) Boundary Layer Thickness of Laminar Sublayer

Open Calculator

fx $$\delta = \frac{11.6 \cdot v}{V*}$$

ex $$0.001402m = \frac{11.6 \cdot 7.25St}{6m/s}$$

4) Centreline Velocity

Open Calculator

fx $$U_{max} = 1.43 \cdot V \cdot \sqrt{1 + f}$$

ex $$2.888458\text{m/s} = 1.43 \cdot 2\text{m/s} \cdot \sqrt{1 + 0.02}$$

5) Centreline Velocity given Shear and Mean Velocity

Open Calculator

fx $$U_{max} = 3.75 \cdot V_* + V$$

ex $$24.5\text{m/s} = 3.75 \cdot 6\text{m/s} + 2\text{m/s}$$

6) Discharge through Pipe given Head Loss in Turbulent Flow

Open Calculator

fx $$Q = \frac{P}{\rho_{fluid} \cdot [g] \cdot h_f}$$

ex $$1.010797\text{m}^3\text{/s} = \frac{170\text{W}}{1.225\text{kg/m}^3 \cdot [g] \cdot 14\text{m}}$$

7) Frictional Factor given Reynolds Number

Open Calculator

fx $$f = 0.0032 + \frac{0.221}{Re^{0.237}}$$

ex $$0.131254 = 0.0032 + \frac{0.221}{(10)^{0.237}}$$

8) Head Loss due to Friction given Power Required in Turbulent Flow

Open Calculator

fx $$h_f = \frac{P}{\rho_{fluid} \cdot [g] \cdot Q}$$

ex $$4.717055m = \frac{170W}{1.225kg/m^3 \cdot [g] \cdot 3m^3/s}$$

9) Mean Velocity given Centreline Velocity

Open Calculator

fx $$V = \frac{U_{max}}{1.43 \cdot \sqrt{1 + f}}$$

ex $$16.61786m/s = \frac{24m/s}{1.43 \cdot \sqrt{1 + 0.02}}$$

10) Mean Velocity given Shear Velocity

Open Calculator

fx $$V = U_{max} - 3.75 \cdot V_*$$

ex $$1.5m/s = 24m/s - 3.75 \cdot 6m/s$$

11) Power Required to Maintain Turbulent Flow

Open Calculator

fx $$P = \rho_{fluid} \cdot [g] \cdot Q \cdot h_f$$

ex $$504.5521W = 1.225kg/m^3 \cdot [g] \cdot 3m^3/s \cdot 14m$$

12) Roughness Reynold Number for Turbulent Flow in Pipes

Open Calculator

fx $$\mathrm{Re} = \frac{\mathrm{k} \cdot \mathrm{V}_*}{\nu}$$

ex $$6 = \frac{0.000725\mathrm{m} \cdot 6\mathrm{m/s}}{7.25\mathrm{St}}$$

13) Shear Stress Developed for Turbulent Flow in Pipes

Open Calculator

fx $$\tau = \rho_{\mathrm{fluid}} \cdot \mathrm{V}_*^2$$

ex $$44.1\mathrm{Pa} = 1.225\mathrm{kg/m^3} \cdot (6\mathrm{m/s})^2$$

14) Shear Stress due to Viscosity

Open Calculator

fx $$\tau = \mu \cdot \mathrm{dv}$$

ex $$20.4\mathrm{Pa} = 10.2\mathrm{P} \cdot 20\mathrm{m/s}$$

15) Shear Stress in Turbulent Flow

Open Calculator

fx $$\tau = \frac{\rho_{\mathrm{fluid}} \cdot \mathrm{f} \cdot \mathrm{v}^2}{2}$$

ex $$44.1\mathrm{Pa} = \frac{1.225\mathrm{kg/m^3} \cdot 0.02 \cdot (60\mathrm{m/s})^2}{2}$$

16) Shear Velocity for Turbulent Flow in Pipes

Open Calculator

fx $$V_* = \sqrt{\frac{\tau}{\rho_{fluid}}}$$

ex $$8.717798\text{m/s} = \sqrt{\frac{93.1\text{Pa}}{1.225\text{kg/m}^3}}$$

17) Shear Velocity given Centreline Velocity

Open Calculator

fx $$V_* = \frac{U_{max} - V}{3.75}$$

ex $$5.866667\text{m/s} = \frac{24\text{m/s} - 2\text{m/s}}{3.75}$$

18) Shear Velocity given Mean Velocity

Open Calculator

fx $$V_* = V \cdot \sqrt{\frac{f}{8}}$$

ex $$0.1\text{m/s} = 2\text{m/s} \cdot \sqrt{\frac{0.02}{8}}$$

Variables Used

- **dv** Change in Velocity *(Meter per Second)*
- **f** Friction Factor
- **h_f** Head Loss due to Friction *(Meter)*
- **k** Average Height Irregularities *(Meter)*
- **P** Power *(Watt)*
- **Q** Discharge *(Cubic Meter per Second)*
- **Re** Roughness Reynold Number
- **U_{max}** Centreline Velocity *(Meter per Second)*
- **v** Velocity *(Meter per Second)*
- **V** Mean Velocity *(Meter per Second)*
- **V_*** Shear Velocity *(Meter per Second)*
- **δ** Boundary Layer Thickness *(Meter)*
- **μ** Viscosity *(Poise)*
- **ν** Kinematic Viscosity *(Stokes)*
- **ρ_{fluid}** Density of Fluid *(Kilogram per Cubic Meter)*
- **τ** Shear Stress *(Pascal)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665 Meter/Second²
  Gravitational acceleration on Earth
- Function: **sqrt**, sqrt(Number)
  Square root function
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Power** in Watt (W)
  Power 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: **Kinematic Viscosity** in Stokes (St)
  Kinematic Viscosity Unit Conversion
- Measurement: **Density** in Kilogram per Cubic Meter (kg/m³)
  Density Unit Conversion
- Measurement: **Stress** in Pascal (Pa)
  Stress Unit Conversion

Check other formula lists

- Boundary Layer Flow Formulas
- Buoyancy Formulas
- Centrifugal pumps Formulas
- Compressible Flow Formulas
- Draft Tube Formulas
- Dynamics of Fluid Flow Formulas
- Flow in Open Channels Formulas
- Forces developed by moving fluid Formulas
- Forces on Submerged Bodies Formulas
- Francis Turbine Formulas
- Hydraulic Linear Actuators Formulas
- Hydraulic Motors Formulas
- Hydraulic Pumps Formulas
- Hydraulic Turbines Formulas
- Ideal flow or Potential flow Formulas
- Kaplan Turbine Formulas
- Kinematics of Flow Formulas
- Notches and Weirs Formulas
- Orifices and Mouthpieces Formulas
- Pelton Turbine Formulas
- Pressure and its Measurements Formulas
- Turbulent Flow Formulas
- Viscous Flow Formulas

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