



[calculatoratoz.com](http://calculatoratoz.com)



[unitsconverters.com](http://unitsconverters.com)

# Turbulent Flow Formulas

Calculators!

Examples!

Conversions!

Bookmark [calculatoratoz.com](http://calculatoratoz.com), [unitsconverters.com](http://unitsconverters.com)

Widest Coverage of Calculators and Growing - **30,000+ Calculators!**  
Calculate With a Different Unit for Each Variable - **In built Unit Conversion!**  
Widest Collection of Measurements and Units - **250+ Measurements!**

Feel free to SHARE this document with your friends!

[Please leave your feedback here...](#)



# List of 18 Turbulent Flow Formulas

## Turbulent Flow

### 1) Average Height of Irregularities for Turbulent Flow in Pipes

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

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#)

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

### 2) Blasius Equation

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

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d\_img.jpg\)](#)

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

### 3) Boundary Layer Thickness of Laminar Sublayer

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

[Open Calculator !\[\]\(f60b7a900783ac3fd531bfd9c111be6d\_img.jpg\)](#)

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



#### 4) Centreline Velocity

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

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235\_img.jpg\)](#)

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

#### 5) Centreline Velocity given Shear and Mean Velocity

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

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0\_img.jpg\)](#)

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

#### 6) Discharge through Pipe given Head Loss in Turbulent Flow

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

[Open Calculator !\[\]\(0d5ec72f61334709c3fc9450209b754f\_img.jpg\)](#)

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

#### 7) Frictional Factor given Reynolds Number

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

[Open Calculator !\[\]\(b64b40baaee5acddc1eab8538ba84754\_img.jpg\)](#)

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




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

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

Open Calculator 


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

9) Mean Velocity given Centreline Velocity 

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

Open Calculator 

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

10) Mean Velocity given Shear Velocity 

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

Open Calculator 

$$ex \quad 1.5\text{m/s} = 24\text{m/s} - 3.75 \cdot 6\text{m/s}$$

11) Power Required to Maintain Turbulent Flow 

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

Open Calculator 

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



## 12) Roughness Reynold Number for Turbulent Flow in Pipes

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

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a\_img.jpg\)](#)

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

## 13) Shear Stress Developed for Turbulent Flow in Pipes

$$fx \quad \tau = \rho_{fluid} \cdot V_*^2$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021\_img.jpg\)](#)

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

## 14) Shear Stress due to Viscosity

$$fx \quad \tau = \mu \cdot dv$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd\_img.jpg\)](#)

$$ex \quad 20.4Pa = 10.2P \cdot 20m/s$$

## 15) Shear Stress in Turbulent Flow

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

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80\_img.jpg\)](#)

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



## 16) Shear Velocity for Turbulent Flow in Pipes

[Open Calculator !\[\]\(eafc244b53721dd1ec133f0772f70fc7\_img.jpg\)](#)

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

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

## 17) Shear Velocity given Centreline Velocity

[Open Calculator !\[\]\(10f8862fc183b400327470ea85afe9ae\_img.jpg\)](#)

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

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

## 18) Shear Velocity given Mean Velocity

[Open Calculator !\[\]\(35dc653d59570f8f891c312eeece91a2\_img.jpg\)](#)

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

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











## 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*)
- **$\delta$**  Boundary Layer Thickness (*Meter*)
- **$\mu$**  Viscosity (*Poise*)
- **$\nu$**  Kinematic Viscosity (*Stokes*)
- **$\rho_{fluid}$**  Density of Fluid (*Kilogram per Cubic Meter*)
- **$\tau$**  Shear Stress (*Pascal*)



## Constants, Functions, Measurements used

- **Constant:** [g], 9.80665 Meter/Second<sup>2</sup>  
*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 (m<sup>3</sup>/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/m<sup>3</sup>)  
*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](#)

Feel free to SHARE this document with your friends!

## PDF Available in

[English](#) [Spanish](#) [French](#) [German](#) [Russian](#) [Italian](#) [Portuguese](#) [Polish](#) [Dutch](#)

10/30/2023 | 7:24:25 AM UTC

[Please leave your feedback here...](#)

