



calculatoratoz.com



unitsconverters.com

Ducts Formulas

Calculators!

Examples!

Conversions!

Bookmark calculatoratoz.com, 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 29 Ducts Formulas

Ducts

Continuity Equation for Ducts

1) Cross-Sectional Area of Duct at Section 1 using Continuity Equation

$$\text{fx } A_1 = \frac{A_2 \cdot V_2}{V_1}$$

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 1.452941\text{m}^2 = \frac{0.95\text{m}^2 \cdot 26\text{m/s}}{17\text{m/s}}$$

2) Cross-Sectional Area of Duct at Section 2 using Continuity Equation

$$\text{fx } A_2 = \frac{A_1 \cdot V_1}{V_2}$$

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 0.95\text{m}^2 = \frac{1.452941\text{m}^2 \cdot 17\text{m/s}}{26\text{m/s}}$$

3) Velocity of Air at Duct Section 1 using Continuity Equation

$$\text{fx } V_1 = \frac{A_2 \cdot V_2}{A_1}$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$\text{ex } 17\text{m/s} = \frac{0.95\text{m}^2 \cdot 26\text{m/s}}{1.452941\text{m}^2}$$



4) Velocity of Air at Duct Section 2 using Continuity Equation

$$fx \quad V_2 = \frac{A_1 \cdot V_1}{A_2}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$ex \quad 26\text{m/s} = \frac{1.452941\text{m}^2 \cdot 17\text{m/s}}{0.95\text{m}^2}$$

Parameters of Ducts

5) Equivalent Diameter of Circular Duct for Rectangular Duct when Quantity of Air is Same

$$fx \quad D_e = 1.256 \cdot \left(\frac{a^3 \cdot b^3}{a + b} \right)^{0.2}$$

[Open Calculator !\[\]\(5361750c22c4e047a52f4eac1ec2d4cc_img.jpg\)](#)

$$ex \quad 0.866503\text{m} = 1.256 \cdot \left(\frac{(0.9\text{m})^3 \cdot (0.7\text{m})^3}{0.9\text{m} + 0.7\text{m}} \right)^{0.2}$$

6) Equivalent Diameter of Circular Duct for Rectangular Duct when Velocity of Air is Same

$$fx \quad D_e = \frac{2 \cdot a \cdot b}{a + b}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$ex \quad 0.7875\text{m} = \frac{2 \cdot 0.9\text{m} \cdot 0.7\text{m}}{0.9\text{m} + 0.7\text{m}}$$



7) Friction Factor for Laminar Flow in Duct

$$fx \quad f_{\text{laminar}} = \frac{64}{\text{Re}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$ex \quad 0.8 = \frac{64}{80}$$

8) Friction Factor for Turbulent Flow in Duct

$$fx \quad f_{\text{turbulent}} = \frac{0.3164}{\text{Re}^{0.25}}$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$ex \quad 0.105795 = \frac{0.3164}{(80)^{0.25}}$$

9) Quantity of Air given Velocity

$$fx \quad Q = V \cdot A_{cs}$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$ex \quad 18.55\text{m}^3/\text{s} = 35\text{m}/\text{s} \cdot 0.53\text{m}^2$$

10) Reynolds Number given Friction Factor for Laminar Flow

$$fx \quad \text{Re} = \frac{64}{f}$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$ex \quad 80 = \frac{64}{0.8}$$



11) Reynolds Number in Duct

$$\text{fx } \text{Re} = \frac{d \cdot V_m}{\nu}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 80.0001 = \frac{533.334\text{m} \cdot 15\text{m/s}}{100\text{m}^2/\text{s}}$$

12) Velocity Pressure in Ducts

$$\text{fx } P_v = 0.6 \cdot V_m^2$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 13.76147\text{mmAq} = 0.6 \cdot (15\text{m/s})^2$$

Pressure

13) Dynamic Loss Coefficient given Dynamic Pressure Loss

$$\text{fx } C = \frac{P_d}{0.6 \cdot V^2}$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 0.02 = \frac{1.498471\text{mmAq}}{0.6 \cdot (35\text{m/s})^2}$$

14) Dynamic Loss Coefficient given Equivalent Additional Length

$$\text{fx } C = \frac{f \cdot L_e}{m}$$

[Open Calculator !\[\]\(e50091943b385fe16d3277389202856f_img.jpg\)](#)

$$\text{ex } 0.02 = \frac{0.8 \cdot 0.00175\text{m}}{0.07\text{m}}$$



15) Dynamic Pressure Loss

$$\text{fx } P_d = C \cdot 0.6 \cdot V^2$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 1.498471\text{mmAq} = 0.02 \cdot 0.6 \cdot (35\text{m/s})^2$$

16) Length of Duct given Pressure Loss due to Friction

$$\text{fx } L = \frac{2 \cdot \Delta P_f \cdot m}{f \cdot \rho_{\text{air}} \cdot V_m^2}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 0.0654\text{m} = \frac{2 \cdot 10.5\text{mmAq} \cdot 0.07\text{m}}{0.8 \cdot 1.225\text{kg/m}^3 \cdot (15\text{m/s})^2}$$


17) Pressure Drop in Circular Duct

$$\text{fx } \Delta P_c = \frac{0.6 \cdot f \cdot L \cdot V_m^2}{\frac{d}{4}}$$

[Open Calculator !\[\]\(ab4e2b3fc7e7887b7a72f548aa6f5e60_img.jpg\)](#)

$$\text{ex } 0.0054\text{mmAq} = \frac{0.6 \cdot 0.8 \cdot 0.0654\text{m} \cdot (15\text{m/s})^2}{\frac{533.334\text{m}}{4}}$$



18) Pressure Drop in Square Duct 

$$fx \quad \Delta P_s = \frac{0.6 \cdot f \cdot L \cdot V_m^2}{\frac{S^2}{2 \cdot (S+S)}}$$

Open Calculator 


$$ex \quad 0.32 \text{mmAq} = \frac{0.6 \cdot 0.8 \cdot 0.0654 \text{m} \cdot (15 \text{m/s})^2}{\frac{(9 \text{m})^2}{2 \cdot (9 \text{m} + 9 \text{m})}}$$

19) Pressure Loss at Discharge or Exit 

$$fx \quad \Delta P_{dis} = 0.6 \cdot V^2$$

Open Calculator 

$$ex \quad 74.92355 \text{mmAq} = 0.6 \cdot (35 \text{m/s})^2$$

20) Pressure Loss at Suction 

$$fx \quad P_d = C \cdot 0.6 \cdot V^2$$

Open Calculator 

$$ex \quad 1.498471 \text{mmAq} = 0.02 \cdot 0.6 \cdot (35 \text{m/s})^2$$

21) Pressure Loss Coefficient at Inlet of Duct 

$$fx \quad C_1 = \left(1 - \frac{A_1}{A_2}\right)^2$$

Open Calculator 

$$ex \quad 0.280277 = \left(1 - \frac{1.452941 \text{m}^2}{0.95 \text{m}^2}\right)^2$$



22) Pressure Loss Coefficient at Outlet of Duct

$$\text{fx } C_2 = \left(\frac{A_2}{A_1} - 1 \right)^2$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$\text{ex } 0.119822 = \left(\frac{0.95\text{m}^2}{1.452941\text{m}^2} - 1 \right)^2$$

23) Pressure Loss due to Friction in Ducts

$$\text{fx } \Delta P_f = \frac{f \cdot L \cdot \rho_{\text{air}} \cdot V_m^2}{2 \cdot m}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{ex } 10.5\text{mmAq} = \frac{0.8 \cdot 0.0654\text{m} \cdot 1.225\text{kg/m}^3 \cdot (15\text{m/s})^2}{2 \cdot 0.07\text{m}}$$

24) Pressure Loss due to Gradual Contraction given Pressure Loss Coefficient at Section 1

$$\text{fx } \Delta P_{gc} = 0.6 \cdot V_1^2 \cdot C_r \cdot C_1$$

[Open Calculator !\[\]\(4688aadfd656ded00cd6bdfae55089a9_img.jpg\)](#)

$$\text{ex } 1.981653\text{mmAq} = 0.6 \cdot (17\text{m/s})^2 \cdot 0.4 \cdot 0.280277$$

25) Pressure Loss due to Gradual Contraction given Velocity of Air at Point 2

$$\text{fx } \Delta P_{gc} = 0.6 \cdot V_2^2 \cdot C_r \cdot C_2$$

[Open Calculator !\[\]\(4146d17f71dced09c6ad789cacceaa6d_img.jpg\)](#)

$$\text{ex } 1.981643\text{mmAq} = 0.6 \cdot (26\text{m/s})^2 \cdot 0.4 \cdot 0.119822$$



26) Pressure Loss due to Sudden Contraction given Velocity of Air at Point 1

$$fx \quad \Delta P_{sc1} = 0.6 \cdot V_1^2 \cdot C$$

[Open Calculator !\[\]\(c3d993ca47bfe2a953c700506ce31fa0_img.jpg\)](#)

$$ex \quad 0.353517\text{mmAq} = 0.6 \cdot (17\text{m/s})^2 \cdot 0.02$$

27) Pressure Loss due to Sudden Contraction given Velocity of Air at point 2

$$fx \quad \Delta P_{sc2} = 0.6 \cdot V_2^2 \cdot C_2$$

[Open Calculator !\[\]\(17413706fd4997a1a4bdf85c6864eee1_img.jpg\)](#)

$$ex \quad 4.954108\text{mmAq} = 0.6 \cdot (26\text{m/s})^2 \cdot 0.119822$$

28) Pressure Loss due to Sudden Enlargement

$$fx \quad \Delta P_{se} = 0.6 \cdot (V_1 - V_2)^2$$

[Open Calculator !\[\]\(4b7a79268f6ba26c1471d4232fffa85a_img.jpg\)](#)

$$ex \quad 4.954128\text{mmAq} = 0.6 \cdot (17\text{m/s} - 26\text{m/s})^2$$

29) Total Pressure required at Inlet to Duct

$$fx \quad P_t = \Delta P_f + P_v$$

[Open Calculator !\[\]\(3342c215b2a8b663596a81468d5dc314_img.jpg\)](#)

$$ex \quad 24.26147\text{mmAq} = 10.5\text{mmAq} + 13.76147\text{mmAq}$$



Variables Used








- **a** Longer Side (*Meter*)
- **A₁** Cross-Sectional Area of Duct at Section 1 (*Square Meter*)
- **A₂** Cross-Sectional Area of Duct at Section 2 (*Square Meter*)
- **A_{CS}** Cross-Sectional Area of Duct (*Square Meter*)
- **b** Shorter Side (*Meter*)
- **C** Dynamic Loss Coefficient
- **C₁** Pressure Loss Coefficient at 1
- **C₂** Pressure Loss Coefficient at 2
- **C_r** Pressure Loss Coefficient
- **d** Diameter of Circular Duct (*Meter*)
- **D_e** Equivalent Diameter of Duct (*Meter*)
- **f** Friction Factor in Duct
- **f_{laminar}** Friction Factor for Laminar Flow
- **f_{turbulent}** Friction Factor for Turbulent Flow in Duct
- **L** Length of Duct (*Meter*)
- **L_e** Equivalent Additional Length (*Meter*)
- **m** Hydraulic Mean Depth (*Meter*)
- **P_d** Dynamic Pressure Loss (*Millimeter Water (4 °C)*)
- **P_t** Total Pressure Required (*Millimeter Water (4 °C)*)
- **P_v** Velocity Pressure in Duct (*Millimeter Water (4 °C)*)
- **Q** Quantity of Air (*Cubic Meter per Second*)
- **Re** Reynolds Number



- **S** Side (Meter)
- **V** Velocity of Air (Meter per Second)
- **V₁** Velocity of Air at Section 1 (Meter per Second)
- **V₂** Velocity of Air at Section 2 (Meter per Second)
- **V_m** Mean Velocity of Air (Meter per Second)
- **ΔP_c** Pressure Drop in Circular Duct (Millimeter Water (4 °C))
- **ΔP_{dis}** Pressure Loss at Discharge (Millimeter Water (4 °C))
- **ΔP_f** Pressure Loss Due to Friction in Ducts (Millimeter Water (4 °C))
- **ΔP_{gc}** Pressure Loss due to Gradual Contraction (Millimeter Water (4 °C))
- **ΔP_s** Pressure Drop in Square Duct (Millimeter Water (4 °C))
- **ΔP_{sc 1}** Pressure Loss due to Sudden Contraction at point 1 (Millimeter Water (4 °C))
- **ΔP_{sc 2}** Pressure Loss due to Sudden Contraction at point 2 (Millimeter Water (4 °C))
- **ΔP_{se}** Pressure Loss due to Sudden Enlargement (Millimeter Water (4 °C))
- **ρ_{air}** Air Density (Kilogram per Cubic Meter)
- **U** Kinematic Viscosity (Square Meter per Second)



Constants, Functions, Measurements used

- **Measurement: Length** in Meter (m)
Length Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Pressure** in Millimeter Water (4 °C) (mmAq)
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: Kinematic Viscosity** in Square Meter per Second (m²/s)
Kinematic Viscosity Unit Conversion 
- **Measurement: Density** in Kilogram per Cubic Meter (kg/m³)
Density Unit Conversion 



Check other formula lists

- [Air Refrigeration Formulas](#) 
- [Ducts Formulas](#) 

Feel free to SHARE this document with your friends!

PDF Available in

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

9/13/2024 | 6:49:58 AM UTC

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

