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Devices to Measure Flow Rate Formulas

Calculators! Examples! Conversions!

List of 25 Devices to Measure Flow Rate Formulas

Devices to Measure Flow Rate

Orifice Meter

1) Actual Velocity at Section 2 given Coefficient of Contraction

fx Open Calculator

$$v = C_v \cdot \sqrt{2 \cdot [g] \cdot h_{venturi} + \left(V_{p2} \cdot C_c \cdot \frac{a_o}{A_i} \right)^2}$$

ex $$11.86091\text{m/s} = 0.92 \cdot \sqrt{2 \cdot [g] \cdot 24\text{mm} + \left(34\text{m/s} \cdot 0.611 \cdot \frac{4.4\text{m}^2}{7.1\text{m}^2} \right)^2}$$

2) Actual Velocity given Theoretical Velocity at Section 2

fx Open Calculator

$$v = C_v \cdot V_{p2}$$

ex $$31.28\text{m/s} = 0.92 \cdot 34\text{m/s}$$

3) Area at Section 2 or at Vena Contracta

fx Open Calculator

$$A_f = C_c \cdot a_o$$

ex $$2.6884\text{m}^2 = 0.611 \cdot 4.4\text{m}^2$$

4) Area of Orifice given Area at Section 2 or at Vena Contracta

Open Calculator

fx $$a_o = \frac{A_f}{C_c}$$

ex $$2.94599\text{m}^2 = \frac{1.8\text{m}^2}{0.611}$$

5) Coefficient of Contraction

Open Calculator

fx $$C_c = \frac{C_d}{C_v}$$

ex $$0.717391 = \frac{0.66}{0.92}$$

6) Coefficient of Contraction given Coefficient of Discharge

Open Calculator

fx $$C_c = \frac{C_d}{C_v}$$

ex $$0.717391 = \frac{0.66}{0.92}$$

7) Coefficient of Discharge given Coefficient of Contraction

Open Calculator

fx $$C_d = C_v \cdot C_c$$

ex $$0.56212 = 0.92 \cdot 0.611$$

8) Coefficient of Velocity given Coefficient of Discharge

Open Calculator

fx $$C_v = \frac{C_d}{C_c}$$

ex $$1.080196 = \frac{0.66}{0.611}$$

9) Discharge through Pipe given Coefficient of Discharge

Open Calculator

fx $$Q_O = C_d \cdot W \cdot (H_{Bottom} - H_{Top}) \cdot \left(\sqrt{2 \cdot 9.81 \cdot H}\right)$$

ex $$0.040529\text{m}^3/\text{s} = 0.66 \cdot 3.1\text{m} \cdot (20\text{m} - 19.9\text{m}) \cdot \left(\sqrt{2 \cdot 9.81 \cdot 0.002\text{m}}\right)$$

10) Theoretical Velocity at Section 1 in Orifice Meter

Open Calculator

fx $$V_1 = \sqrt{(V_{p2}^2) - (2 \cdot [g] \cdot h_{venturi})}$$

ex $$33.99308\text{m/s} = \sqrt{\left((34\text{m/s})^2\right) - (2 \cdot [g] \cdot 24\text{mm})}$$

11) Theoretical Velocity at Section 2 in Orifice Meter

Open Calculator

fx $$V_{p2} = \sqrt{2 \cdot [g] \cdot h_{venturi} + V_1^2}$$

ex $$58.03406\text{m/s} = \sqrt{2 \cdot [g] \cdot 24\text{mm} + (58.03\text{m/s})^2}$$

Pitot Tube

12) Actual Velocity of Flowing Stream

Open Calculator

$$v = C_v \cdot \sqrt{2 \cdot [g] \cdot H_f}$$

$$14.17281 \mathrm{m/s} = 0.92 \cdot \sqrt{2 \cdot [g] \cdot 12.10}$$

13) Height of Fluid raised in Tube given Actual Velocity of Flowing Stream

Open Calculator

$$H_f = \frac{\left(\frac{V_{theoritical}}{C_v}\right)^2}{2} \cdot [g]$$

$$13.0346 = \frac{\left(\frac{1.5 \mathrm{m/s}}{0.92}\right)^2}{2} \cdot [g]$$

14) Height of Fluid raised in Tube given Theoretical Velocity of Flowing Stream

Open Calculator

$$H_f = \frac{V_{theoritical}^2}{2} \cdot [g]$$

$$11.03248 = \frac{(1.5 \mathrm{m/s})^2}{2} \cdot [g]$$

15) Theoretical Velocity of Flowing Stream

Open Calculator

fx $$V_{theoritical} = \sqrt{2 \cdot [g] \cdot H_f}$$

ex $$15.40522 \text{m/s} = \sqrt{2 \cdot [g] \cdot 12.10}$$

Venturi Meter

16) Actual Discharge given Coefficient of Discharge

Open Calculator

fx $$Q_{actual} = V_{theoritical} \cdot C_d$$

ex $$0.99 \text{m}^3/\text{s} = 1.5 \text{m/s} \cdot 0.66$$

17) Coefficient of Discharge given Discharges

Open Calculator

fx $$C_d = \frac{Q_{actual}}{V_{theoritical}}$$

ex $$0.391333 = \frac{0.587 \text{m}^3/\text{s}}{1.5 \text{m/s}}$$

18) Density of Liquid in Pipe given Venturi Head

Open Calculator

fx $$\gamma_f = \frac{w}{\frac{h_{venturi}}{L} + 1}$$

ex $$9.810357 \text{kN/m}^3 = \frac{9888.84 \text{N/m}^3}{\frac{24 \text{mm}}{3 \text{m}} + 1}$$

19) Density of Manometric Liquid given Venturi Head

Open Calculator

fx $$w = \gamma_f \cdot \left(\frac{h_{venturi}}{L} + 1 \right)$$

ex $$9888.48 \text{N/m}^3 = 9.81 \text{kN/m}^3 \cdot \left(\frac{24\text{mm}}{3\text{m}} + 1 \right)$$

20) Inlet Area given Theoretical Discharge

Open Calculator

fx $$A_i = \sqrt{\frac{(Q_{th} \cdot A_f)^2}{(Q_{th})^2 - (A_f^2 \cdot 2 \cdot [g] \cdot h_{venturi})}}$$

ex $$7.073493 \text{m}^2 = \sqrt{\frac{(1.277 \text{m}^3/\text{s} \cdot 1.8 \text{m}^2)^2}{(1.277 \text{m}^3/\text{s})^2 - \left((1.8 \text{m}^2)^2 \cdot 2 \cdot [g] \cdot 24\text{mm}\right)}}$$

21) Theoretical Discharge given Coefficient of Discharge

Open Calculator

fx $$Q_{th} = \frac{Q_{actual}}{C_d}$$

ex $$0.889394 \text{m}^3/\text{s} = \frac{0.587 \text{m}^3/\text{s}}{0.66}$$

22) Theoretical Discharge through Pipe

Open Calculator

fx $$Q_{th} = \frac{A_i \cdot A_f \cdot \left(\sqrt{2 \cdot [g] \cdot h_{venturi}}\right)}{\sqrt{(A_i)^2 - (A_f)^2}}$$

ex $$1.276671\text{m}^3/\text{s} = \frac{7.1\text{m}^2 \cdot 1.8\text{m}^2 \cdot \left(\sqrt{2 \cdot [g] \cdot 24\text{mm}}\right)}{\sqrt{(7.1\text{m}^2)^2 - (1.8\text{m}^2)^2}}$$

23) Throat Area given Theoretical Discharge

Open Calculator

fx $$A_f = \sqrt{\frac{(A_i \cdot Q_{th})^2}{\left(A_i^2 \cdot 2 \cdot [g] \cdot h_{venturi}\right) + Q_{th}^2}}$$

ex $$1.800435\text{m}^2 = \sqrt{\frac{(7.1\text{m}^2 \cdot 1.277\text{m}^3/\text{s})^2}{\left((7.1\text{m}^2)^2 \cdot 2 \cdot [g] \cdot 24\text{mm}\right) + (1.277\text{m}^3/\text{s})^2}}$$

24) Venturi Head given Difference in Levels of Manometric Liquid in Two Limbs

Open Calculator

fx $$h_{venturi} = L \cdot \left(\frac{w}{\gamma_f} - 1\right)$$

ex $$24.11009\text{mm} = 3\text{m} \cdot \left(\frac{9888.84\text{N}/\text{m}^3}{9.81\text{kN}/\text{m}^3} - 1\right)$$

25) Venturi Head given Theoretical Discharge through Pipe

Open Calculator

fx
$$h_{venturi} = \left(\left(\frac{Q_{th}}{A_i \cdot A_f} \right) \cdot \left(\sqrt{\frac{(A_i)^2 - (A_f)^2}{2 \cdot [g]}} \right) \right)^2$$

ex
$$24.01238\text{mm} = \left(\left(\frac{1.277\text{m}^3/\text{s}}{7.1\text{m}^2 \cdot 1.8\text{m}^2} \right) \cdot \left(\sqrt{\frac{(7.1\text{m}^2)^2 - (1.8\text{m}^2)^2}{2 \cdot [g]}} \right) \right)^2$$

Variables Used

- A_f Cross Section Area 2 *(Square Meter)*
- A_i Cross Section Area 1 *(Square Meter)*
- a_o Area of Orifice *(Square Meter)*
- C_c Coefficient of Contraction
- C_d Coefficient of Discharge
- C_v Coefficient of Velocity
- H Difference in Liquid Level *(Meter)*
- H_{Bottom} Height of Liquid Bottom Edge *(Meter)*
- H_f Height of Fluid
- H_{Top} Height of Liquid Top Edge *(Meter)*
- $h_{venturi}$ Venturi Head *(Millimeter)*
- L Length of Venturi meter *(Meter)*
- Q_{actual} Actual Discharge *(Cubic Meter per Second)*
- Q_O Discharge through Orifice *(Cubic Meter per Second)*
- Q_{th} Theoretical Discharge *(Cubic Meter per Second)*
- v Actual Velocity *(Meter per Second)*
- V_1 Velocity at Point 1 *(Meter per Second)*
- V_{p2} Velocity at Point 2 *(Meter per Second)*
- $V_{theoritical}$ Theoretical Velocity *(Meter per Second)*
- W Width of Pipe *(Meter)*
- γ_f Specific Weight of Liquid *(Kilonewton per Cubic Meter)*

- w Weight per unit Volume of Manometer Fluid *(Newton per Cubic Meter)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **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 Millimeter (mm), Meter (m)
  Length Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area 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: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³), Newton per Cubic Meter (N/m³)
  Specific Weight Unit Conversion

Check other formula lists

- Buoyancy And Floatation Formulas
- Culverts Formulas
- Devices to Measure Flow Rate Formulas
- Equations of Motion and Energy Equation Formulas
- Flow of Compressible Fluids Formulas
- Flow Over Notches and Weirs Formulas
- Fluid Pressure and Its Measurement Formulas
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- Hydroelectric Power Generation Formulas
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- Liquids in Relative Equilibrium Formulas
- Most Efficient Section of Channel Formulas
- Non uniform Flow in Channels Formulas
- Properties of Fluid Formulas
- Thermal Expansion of Pipe and Pipe Stresses Formulas
- Uniform Flow in Channels Formulas
- Water Power Engineering Formulas