

Important Force Exerted by Fluid Jet on Moving Flat Plate Formulas PDF



Formulas
Examples
with Units

List of 23 Important Force Exerted by Fluid Jet on Moving Flat Plate Formulas

1) Flat Plate Inclined at an Angle to the Jet Formulas

1.1) Dynamic Thrust Exerted by Jet on Plate Formula

Formula

Evaluate Formula

$$F_t = \left(\frac{\gamma_f \cdot A_{\text{jet}} \cdot (V_{\text{absolute}} - v)^2}{G} \right) \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)$$

Example with Units

$$2.1768 \text{ kN} = \left(\frac{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2}{10} \right) \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)$$

1.2) Normal Thrust Normal to Direction of Jet Formula

Formula

Evaluate Formula

$$F_t = \left(\frac{\gamma_f \cdot A_{\text{jet}} \cdot (V_{\text{absolute}} - v)^2}{G} \right) \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right) \cdot \cos(\theta)$$

Example with Units

$$1.8851 \text{ kN} = \left(\frac{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2}{10} \right) \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right) \cdot \cos(30^\circ)$$



1.3) Normal Thrust Parallel to Direction of Jet Formula

Formula

$$F_t = \left(\frac{\gamma_f \cdot A_{\text{jet}} \cdot (V_{\text{absolute}} - v)^2}{G} \right) \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)$$

Evaluate Formula 

Example with Units

$$2.1768 \text{ kN} = \left(\frac{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2}{10} \right) \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)$$

1.4) Absolute Velocity Formulas

1.4.1) Absolute velocity for dynamic thrust exerted by jet on plate Formula

Formula

$$V_{\text{absolute}} = \left(\sqrt{\frac{m_f \cdot G}{\gamma_f \cdot A_{\text{jet}} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)}} \right) + v$$

Evaluate Formula 

Example with Units

$$9.6983 \text{ m/s} = \left(\sqrt{\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)}} \right) + 9.69 \text{ m/s}$$

1.4.2) Absolute Velocity for given Normal Thrust Normal to Direction of Jet Formula

Formula

$$V_{\text{absolute}} = \left(\sqrt{\frac{F_t \cdot G}{\gamma_f \cdot A_{\text{jet}} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right) \cdot \cos(\theta)}} \right) + v$$

Evaluate Formula 

Example with Units

$$16.3673 \text{ m/s} = \left(\sqrt{\frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right) \cdot \cos(30^\circ)}} \right) + 9.69 \text{ m/s}$$



1.4.3) Absolute Velocity for given Normal Thrust Parallel to Direction of Jet Formula

Evaluate Formula 

Formula

$$V_{\text{absolute}} = \sqrt{\frac{F_t \cdot G}{\gamma_f \cdot A_{\text{jet}} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)^2} + v}$$

Example with Units

$$9.7492 \text{ m/s} = \sqrt{\frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)^2} + 9.69 \text{ m/s}}$$

1.4.4) Absolute Velocity for Mass of Fluid Striking Plate Formula

Formula

$$V_{\text{absolute}} = \left(\frac{m_f \cdot G}{\gamma_f \cdot A_{\text{jet}}} \right) + v$$

Example with Units

$$9.6908 \text{ m/s} = \left(\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2} \right) + 9.69 \text{ m/s}$$

Evaluate Formula 

1.5) Cross Sectional Area Formulas

1.5.1) Cross Section Area for Mass of Fluid Striking Plate Formula

Formula

$$A_{\text{jet}} = \frac{m_f \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v)}$$

Example with Units

$$2.2376 \text{ m}^2 = \frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})}$$

Evaluate Formula 

1.5.2) Cross Sectional Area for given Dynamic Thrust Exerted by Jet on Plate Formula

Evaluate Formula 

Formula

$$A_{\text{jet}} = \frac{m_f \cdot G}{\gamma_f \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right) \cdot (V_{\text{absolute}} - v_{\text{jet}})^2}$$

Example with Units

$$0.0231 \text{ m}^2 = \frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right) \cdot (10.1 \text{ m/s} - 12 \text{ m/s})^2}$$



1.5.3) Cross Sectional Area for given Normal Thrust Normal to Direction of Jet Formula

Formula

Evaluate Formula 

$$A_{\text{Jet}} = \frac{F_t \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v)^2 \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right) \cdot \cos(\theta)}$$

Example with Units

$$0.3183 \text{ m}^2 = \frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right) \cdot \cos(30^\circ)}$$

1.5.4) Cross Sectional Area for given Work Done by Jet per Second Formula

Formula

Evaluate Formula 

$$A_{\text{Jet}} = \frac{F_t \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v_{\text{jet}})^2 \cdot V_j \cdot \angle D^2}$$

Example with Units

$$0.4256 \text{ m}^2 = \frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 12 \text{ m/s})^2 \cdot 9 \text{ m/s} \cdot 11^\circ^2}$$

1.6) Velocity of Jet Formulas

1.6.1) Velocity of jet for dynamic thrust exerted by jet on plate Formula

Formula

Evaluate Formula 

$$v = - \left(\sqrt{\frac{m_f \cdot G}{\gamma_f \cdot A_{\text{Jet}} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)}} - V_{\text{absolute}} \right)$$

Example with Units

$$10.0917 \text{ m/s} = - \left(\sqrt{\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)}} - 10.1 \text{ m/s} \right)$$



1.6.2) Velocity of Jet given Normal Thrust Normal to Direction of Jet Formula

Evaluate Formula 

Formula

$$v = - \left(\sqrt{\frac{F_t \cdot G}{\gamma_f \cdot A_{jet} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right) \cdot \cos(\theta)}} \right) + V_{absolute}$$

Example with Units

$$9.8888 \text{ m/s} = - \left(\sqrt{\frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right) \cdot \cos(30^\circ)}} \right) + 10.1 \text{ m/s}$$

1.6.3) Velocity of Jet given Normal Thrust Parallel to Direction of Jet Formula

Evaluate Formula 

Formula

$$v = - \left(\sqrt{\frac{F_t \cdot G}{\gamma_f \cdot A_{jet} \cdot \left(\angle D \cdot \left(\frac{180}{\pi} \right) \right)^2} - V_{absolute}} \right)$$

Example with Units

$$10.0408 \text{ m/s} = - \left(\sqrt{\frac{0.5 \text{ kN} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{3.1416} \right) \right)^2} - 10.1 \text{ m/s}} \right)$$

2) Flat Plate Normal to the Jet Formulas

2.1) Absolute Velocity given Thrust Exerted by Jet on Plate Formula

Evaluate Formula 

Formula

$$V_{absolute} = \left(\sqrt{\frac{m_f \cdot G}{\gamma_f \cdot A_{jet}}} \right) + v$$

Example with Units

$$9.7177 \text{ m/s} = \left(\sqrt{\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2}} \right) + 9.69 \text{ m/s}$$



2.2) Dynamic Thrust Exerted on Plate by Jet Formula

Formula

$$F_t = \frac{\gamma_f \cdot A_{\text{jet}} \cdot (V_{\text{absolute}} - v)^2}{G}$$

Evaluate Formula 

Example with Units

$$0.1979 \text{ kN} = \frac{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2}{10}$$

2.3) Efficiency of Wheel Formula

Formula

$$\eta = \frac{2 \cdot v \cdot (V_{\text{absolute}} - v)}{V_{\text{absolute}}^2}$$

Example with Units

$$0.0779 = \frac{2 \cdot 9.69 \text{ m/s} \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})}{10.1 \text{ m/s}^2}$$

Evaluate Formula 

2.4) Velocity of jet for mass of fluid striking plate Formula

Formula

$$v = - \left(\left(\frac{m_f \cdot G}{\gamma_f \cdot A_{\text{jet}}} \right) - V_{\text{absolute}} \right)$$

Example with Units

$$10.0992 \text{ m/s} = - \left(\left(\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2} \right) - 10.1 \text{ m/s} \right)$$

Evaluate Formula 

2.5) Velocity of jet given dynamic thrust exerted by jet on plate Formula

Formula

$$v = - \left(\sqrt{\frac{m_f \cdot G}{\gamma_f \cdot A_{\text{jet}}}} - V_{\text{absolute}} \right)$$

Example with Units

$$10.0723 \text{ m/s} = - \left(\sqrt{\frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2}} - 10.1 \text{ m/s} \right)$$

Evaluate Formula 

2.6) Work Done by Jet on Plate per Second Formula

Formula

$$w = \frac{\gamma_f \cdot A_{\text{jet}} \cdot (V_{\text{absolute}} - v)^2 \cdot v}{G}$$

Evaluate Formula 

Example with Units

$$1.9175 \text{ kJ} = \frac{9.81 \text{ kN/m}^3 \cdot 1.2 \text{ m}^2 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2 \cdot 9.69 \text{ m/s}}{10}$$



2.7) Cross Sectional Area Formulas

2.7.1) Cross Sectional Area given Dynamic Thrust Exerted by Jet on Plate Formula

Formula

$$A_{\text{Jet}} = \frac{m_f \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v)^2}$$

Example with Units

$$5.4577 \text{ m}^2 = \frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2}$$

Evaluate Formula 

2.7.2) Cross Sectional Area given Mass of Fluid Striking Plate Formula

Formula

$$A_{\text{Jet}} = \frac{m_f \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v)}$$

Example with Units

$$2.2376 \text{ m}^2 = \frac{0.9 \text{ kg} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})}$$

Evaluate Formula 

2.7.3) Cross Sectional Area given Work Done by Jet on Plate per Second Formula

Formula

$$A_{\text{Jet}} = \frac{w \cdot G}{\gamma_f \cdot (V_{\text{absolute}} - v)^2 \cdot v}$$

Example with Units

$$2.4406 \text{ m}^2 = \frac{3.9 \text{ kJ} \cdot 10}{9.81 \text{ kN/m}^3 \cdot (10.1 \text{ m/s} - 9.69 \text{ m/s})^2 \cdot 9.69 \text{ m/s}}$$








Evaluate Formula 



Variables used in list of Force Exerted by Fluid Jet on Moving Flat Plate Formulas above



- $\angle D$ Angle between Jet and Plate (Degree)
- A_{Jet} Cross Sectional Area of Jet (Square Meter)
- F_t Thrust Force (Kilonewton)
- G Specific Gravity of Fluid
- m_f Fluid Mass (Kilogram)
- v Velocity of Jet (Meter per Second)
- V_{absolute} Absolute Velocity of Issuing Jet (Meter per Second)
- V_j Jet Velocity (Meter per Second)
- v_{jet} Fluid Jet Velocity (Meter per Second)
- w Work Done (Kilojoule)
- γ_f Specific Weight of Liquid (Kilonewton per Cubic Meter)
- η Efficiency of Jet
- θ Theta (Degree)

Constants, Functions, Measurements used in list of Force Exerted by Fluid Jet on Moving Flat Plate Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288
Archimedes' constant
- **Functions:** cos, cos(Angle)
Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- **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: Weight** in Kilogram (kg)
Weight Unit Conversion 
- **Measurement: Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Energy** in Kilojoule (KJ)
Energy Unit Conversion 
- **Measurement: Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement: Angle** in Degree (°)
Angle Unit Conversion 
- **Measurement: Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
Specific Weight Unit Conversion 



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