



Force Exerted by Fluid Jet on Moving Flat Plate Formulas

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

Force Exerted by Fluid Jet on Moving Flat Plate

Flat Plate Inclined at an Angle to the Jet

1) Dynamic Thrust Exerted by Jet on Plate

 $ext{Ft} = \left(rac{\gamma_{ ext{f}} \cdot ext{A}_{ ext{Jet}} \cdot \left(ext{V}_{ ext{absolute}} - ext{v}
ight)^2}{ ext{G}}
ight) \cdot \left(extsup ext{D} \cdot \left(rac{180}{\pi}
ight)
ight)^{-1}$

Open Calculator

 $2.176761 \text{kN} = \left(\frac{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(10.1 \text{m/s} - 9.69 \text{m/s} \right)^2}{10} \right) \cdot \left(11^\circ \cdot \left(\frac{180}{\pi} \right) \right)$

2) Normal Thrust Normal to Direction of Jet

Open Calculator 2

 $ext{Ft} = \left(rac{\gamma_{
m f} \cdot {
m A}_{
m Jet} \cdot \left({
m V}_{
m absolute} - {
m v}
ight)^2}{
m G}
ight) \cdot \left(oto {
m D} \cdot \left(rac{180}{\pi}
ight)
ight) \cdot \cos(heta)^2$

ex

$$1.88513 \text{kN} = \left(\frac{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(10.1 \text{m/s} - 9.69 \text{m/s}\right)^2}{10}\right) \cdot \left(11^{\circ} \cdot \left(\frac{180}{\pi}\right)\right) \cdot \cos(30^{\circ})$$

3) Normal Thrust Parallel to Direction of Jet

$$ext{Ft} = \left(rac{\gamma_{
m f} \cdot A_{
m Jet} \cdot \left(V_{
m absolute} - v
ight)^2}{G}
ight) \cdot \left(\angle D \cdot \left(rac{180}{\pi}
ight)
ight)^2$$

Open Calculator

 $2.176761 \text{kN} = \left(\frac{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(10.1 \text{m/s} - 9.69 \text{m/s} \right)^2}{10} \right) \cdot \left(11^{\circ} \cdot \left(\frac{180}{\pi} \right) \right)$





Absolute Velocity 🗗

4) Absolute velocity for dynamic thrust exerted by jet on plate

$$extbf{V}_{absolute} = \left(\sqrt{rac{ ext{m}_{ ext{f}} \cdot ext{G}}{\gamma_{ ext{f}} \cdot ext{A}_{ ext{Jet}} \cdot \left(\angle ext{D} \cdot \left(rac{180}{\pi}
ight)
ight)}}
ight) + ext{v}$$

Open Calculator 🚰

$$\boxed{ 9.698337 \text{m/s} = \left(\sqrt{\frac{0.9 \text{kg} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{\pi}\right)\right)}} \right) + 9.69 \text{m/s} }$$

5) Absolute Velocity for given Normal Thrust Normal to Direction of Jet

$$V_{absolute} = \left(\sqrt{rac{Ft \cdot G}{\gamma_f \cdot A_{Jet} \cdot \left(\angle D \cdot \left(rac{180}{\pi}
ight)
ight) \cdot \cos(heta)}}
ight) + v$$

Open Calculator

$$\boxed{ 16.36726 \text{m/s} = \left(\sqrt{\frac{0.5 \text{kN} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{\pi}\right)\right) \cdot \cos(30^\circ)} \right) + 9.69 \text{m/s} }$$

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

$$extbf{V}_{absolute} = \sqrt{rac{ ext{Ft} \cdot ext{G}}{\gamma_{ ext{f}} \cdot ext{A}_{ ext{Jet}} \cdot \left(extstyle ext{D} \cdot \left(rac{180}{\pi}
ight)
ight)^2}} + ext{v}$$

Open Calculator

$$\boxed{ 9.749247 \text{m/s} = \sqrt{\frac{0.5 \text{kN} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(11^\circ \cdot \left(\frac{180}{\pi}\right)\right)^2}} + 9.69 \text{m/s} }$$

7) Absolute Velocity for Mass of Fluid Striking Plate

$$V_{absolute} = \left(rac{m_f \cdot G}{\gamma_f \cdot A_{Jet}}
ight) + v$$





Cross Sectional Area

8) Cross Section Area for Mass of Fluid Striking Plate

$$oldsymbol{ iny A_{Jet}} = rac{\mathrm{m_f \cdot G}}{\gamma_{\mathrm{f}} \cdot (\mathrm{V_{absolute}} - \mathrm{v})}$$

Open Calculator 🗹

$$\boxed{ 2.237637 m^2 = \frac{0.9 kg \cdot 10}{9.81 kN/m^3 \cdot (10.1 m/s - 9.69 m/s)} }$$

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

$$oldsymbol{ iny A_{Jet}} = rac{m_f \cdot G}{\gamma_f \cdot \left(\angle D \cdot \left(rac{180}{\pi}
ight)
ight) \cdot \left(V_{absolute} - v_{jet}
ight)^2}$$

Open Calculator

$$\boxed{ 0.023103 \text{m}^2 = \frac{0.9 \text{kg} \cdot 10}{9.81 \text{kN/m}^3 \cdot \left(11^\circ \cdot \left(\frac{180}{\pi}\right)\right) \cdot \left(10.1 \text{m/s} - 12 \text{m/s}\right)^2 } }$$

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

 $\boxed{\mathbf{K}} \mathbf{A}_{Jet} = \frac{Ft \cdot G}{\gamma_f \cdot \left(V_{absolute} - v\right)^2 \cdot \left(\angle D \cdot \left(\frac{180}{\pi}\right)\right) \cdot \cos(\theta)}$

Open Calculator 🗗

11) Cross Sectional Area for given Work Done by Jet per Second 🗲

$$\mathbf{K} \mathbf{A}_{\mathrm{Jet}} = rac{\mathrm{Ft} \cdot \mathrm{G}}{\gamma_{\mathrm{f}} \cdot \left(\mathrm{V}_{\mathrm{absolute}} - \mathrm{v}_{\mathrm{jet}}
ight)^2 \cdot \mathrm{V}_{\mathrm{j}} \cdot \angle \mathrm{D}^2}$$

$$\boxed{ 0.425609 \text{m}^2 = \frac{0.5 \text{kN} \cdot 10}{9.81 \text{kN/m}^3 \cdot \left(10.1 \text{m/s} - 12 \text{m/s}\right)^2 \cdot 9 \text{m/s} \cdot \left(11^\circ\right)^2 } }$$



Velocity of Jet

12) Velocity of jet for dynamic thrust exerted by jet on plate

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

Open Calculator

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

13) Velocity of Jet given Normal Thrust Normal to Direction of Jet

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

Open Calculator

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

14) Velocity of Jet given Normal Thrust Parallel to Direction of Jet

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

$$\boxed{ 10.04075 \text{m/s} = - \Bigg(\sqrt{\frac{0.5 \text{kN} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(11\degree \cdot \left(\frac{180}{\pi}\right)\right)^2} - 10.1 \text{m/s} \Bigg) }$$



Flat Plate Normal to the Jet

15) Absolute Velocity given Thrust Exerted by Jet on Plate

 $V_{
m absolute} = \left(\sqrt{rac{m_{
m f} \cdot G}{\gamma_{
m f} \cdot A_{
m Jet}}}
ight) + {
m v}$

Open Calculator 🗗

16) Dynamic Thrust Exerted on Plate by Jet

 $\mathrm{Ft} = rac{\gamma_{\mathrm{f}} \cdot \mathrm{A}_{\mathrm{Jet}} \cdot \left(\mathrm{V}_{\mathrm{absolute}} - \mathrm{v}
ight)^2}{\mathrm{G}}$

Open Calculator

 $\boxed{ 0.197887 \text{kN} = \frac{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot (10.1 \text{m/s} - 9.69 \text{m/s})^2}{10} }$

17) Efficiency of Wheel

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

Open Calculator 🗗

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

18) Velocity of jet for mass of fluid striking plate

 $\mathbf{v} = - \left(\left(rac{m_f \cdot G}{\gamma_f \cdot A_{Jet}}
ight) - V_{absolute}
ight)$

Open Calculator

 $\boxed{ 10.09924 \text{m/s} = - \bigg(\bigg(\frac{0.9 \text{kg} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2} \bigg) - 10.1 \text{m/s} \bigg) }$



19) Velocity of jet given dynamic thrust exerted by jet on plate

 $v = - \overline{\left(\sqrt{rac{m_f \cdot G}{\gamma_f \cdot A_{Jet}}} - V_{absolute}
ight)}$

Open Calculator 🗗

 $= 10.07235 \text{m/s} = -\left(\sqrt{\frac{0.9 \text{kg} \cdot 10}{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2}} - 10.1 \text{m/s}\right)$

20) Work Done by Jet on Plate per Second

 $\mathbf{w} = rac{\gamma_{\mathrm{f}} \cdot A_{\mathrm{Jet}} \cdot \left(V_{\mathrm{absolute}} - v
ight)^2 \cdot v}{G}$

Open Calculator

 $\boxed{1.917528 \text{KJ} = \frac{9.81 \text{kN/m}^3 \cdot 1.2 \text{m}^2 \cdot \left(10.1 \text{m/s} - 9.69 \text{m/s}\right)^2 \cdot 9.69 \text{m/s}}{10} }$

Cross Sectional Area

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

 $\mathbf{A}_{\mathrm{Jet}} = rac{\mathrm{m_f \cdot G}}{\mathrm{\gamma_f \cdot (V_{\mathrm{absolute}} - v)}^2}$

Open Calculator

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

22) Cross Sectional Area given Mass of Fluid Striking Plate

 $oldsymbol{\mathsf{fx}} egin{equation} A_{\mathrm{Jet}} = rac{m_{\mathrm{f}} \cdot G}{\gamma_{\mathrm{f}} \cdot (V_{\mathrm{absolute}} - v)} \end{split}$

$$\mathbf{ex} = \frac{0.9 \mathrm{kg} \cdot 10}{9.81 \mathrm{kN/m^3} \cdot (10.1 \mathrm{m/s} - 9.69 \mathrm{m/s})}$$



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

$$\mathbf{\hat{x}} \mathbf{A}_{\mathrm{Jet}} = rac{\mathbf{w} \cdot \mathbf{G}}{\gamma_{\mathrm{f}} \cdot \left(\mathbf{V}_{\mathrm{absolute}} - \mathbf{v}
ight)^2 \cdot \mathbf{v}}$$



Variables Used

- ∠D Angle between Jet and Plate (Degree)
- A_{Jet} Cross Sectional Area of Jet (Square Meter)
- **Ft** Thrust Force (Kilonewton)
- · G Specific Gravity of Fluid
- m_f Fluid Mass (Kilogram)
- **v** Velocity of Jet (Meter per Second)
- Vabsolute Absolute Velocity of Issuing Jet (Meter per Second)
- V_i Jet Velocity (Meter per Second)
- V_{iet} Fluid Jet Velocity (Meter per Second)
- W Work Done (Kilojoule)
- Vf Specific Weight of Liquid (Kilonewton per Cubic Meter)
- η Efficiency of Jet
- θ Theta (Degree)





Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
 Archimedes' constant
- Function: cos, cos(Angle)

 Trigonometric cosine function
- Function: sqrt, sqrt(Number)
 Square root function
- 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





Check other formula lists

- Force Exerted by Fluid Jet on Moving Curved Vane Formulas
- Force Exerted by Fluid Jet on Moving Flat Plate Formulas

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