Force Exerted by Fluid Jet on Stationary Flat Plate Formulas

List of 22 Force Exerted by Fluid Jet on Stationary Flat Plate Formulas

Force Exerted by Fluid Jet on Stationary Flat Plate

Flat Plate Inclined at an Angle to the Jet

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

Open Calculator

fx $$A_{Jet} = \frac{F_Y \cdot [g]}{\gamma_f \cdot v_{jet}^2 \cdot \sin(\angle D) \cdot \cos(\angle D)}$$

ex $$1.408404\text{m}^2 = \frac{38\text{kN} \cdot [g]}{9.81\text{kN/m}^3 \cdot (12\text{m/s})^2 \cdot \sin(11^\circ) \cdot \cos(11^\circ)}$$

2) Cross Sectional Area of Jet for given Dynamic Thrust Parallel to Direction of Jet

Open Calculator

fx $$A_{Jet} = \frac{F_X \cdot [g]}{\gamma_f \cdot v_{jet}^2 \cdot (\sin(\angle D))^2}$$

ex $$1.944875\text{m}^2 = \frac{10.2\text{kN} \cdot [g]}{9.81\text{kN/m}^3 \cdot (12\text{m/s})^2 \cdot (\sin(11^\circ))^2}$$

3) Cross Sectional Area of Jet for given Thrust Exerted in Direction of Normal to Plate

Open Calculator

fx $$A_{Jet} = \frac{F_p \cdot [g]}{\gamma_f \cdot v_{jet}^2 \cdot (\sin(\angle D))}$$

ex $$1.41891m^2 = \frac{39kN \cdot [g]}{9.81kN/m^3 \cdot (12m/s)^2 \cdot (\sin(11°))}$$

4) Discharge Flowing by Jet

Open Calculator

fx $$Q = Q_{x,y} + Q_{x,y}$$

ex $$1.02m^3/s = 0.51m^3/s + 0.51m^3/s$$

5) Discharge Flowing in Direction Normal to Plate

Open Calculator

fx $$Q_{x,y} = \left(\frac{Q}{2}\right) \cdot (1 + \cos(\angle D))$$

ex $$1.000722m^3/s = \left(\frac{1.01m^3/s}{2}\right) \cdot (1 + \cos(11°))$$

6) Discharge Flowing in Direction Parallel to Plate

Open Calculator

fx $$Q_{x,y} = \left(\frac{Q}{2}\right) \cdot (1 - \cos(\angle D))$$

ex $$0.009278m^3/s = \left(\frac{1.01m^3/s}{2}\right) \cdot (1 - \cos(11°))$$

7) Force Exerted by Jet in Direction Normal to Plate

Open Calculator

fx
$$F_p = \left(\frac{\gamma_f \cdot A_{Jet} \cdot \left(v_{jet}^2\right)}{[g]}\right) \cdot \sin(\angle D)$$

ex
$$32.98306\text{kN} = \left(\frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot \left((12\text{m/s})^2\right)}{[g]}\right) \cdot \sin(11°)$$

8) Force Exerted by Jet Normal to Direction of Jet Normal to Plate

Open Calculator

fx
$$F_Y = \left(\frac{\gamma_f \cdot A_{Jet} \cdot v_{jet}^2}{[g]}\right) \cdot \sin(\angle D) \cdot \cos(\angle D)$$

ex
$$32.37707\text{kN} = \left(\frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (12\text{m/s})^2}{[g]}\right) \cdot \sin(11°) \cdot \cos(11°)$$

9) Force Exerted by Jet Parallel to Direction of Jet Normal to Plate

Open Calculator

fx
$$F_X = \left(\frac{\gamma_f \cdot A_{Jet} \cdot v_{jet}^2}{[g]}\right) \cdot (\sin(\angle D))^2$$

ex
$$6.293464\text{kN} = \left(\frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (12\text{m/s})^2}{[g]}\right) \cdot (\sin(11°))^2$$

10) Velocity of Fluid given Thrust Exerted Normal to Plate

Open Calculator

fx $$v_{jet} = \sqrt{\frac{F_p \cdot [g]}{\gamma_f \cdot A_{Jet} \cdot (\sin(\angle D))}}$$

ex $$13.04873\text{m/s} = \sqrt{\frac{39\text{kN} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (\sin(11°))}}$$

11) Velocity of Fluid given Thrust Normal to Jet

Open Calculator

fx $$v_{jet} = \sqrt{\frac{F_Y \cdot [g]}{\gamma_f \cdot A_{Jet} \cdot (\sin(\angle D)) \cdot \cos(\angle D)}}$$

ex $$13.00033\text{m/s} = \sqrt{\frac{38\text{kN} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (\sin(11°)) \cdot \cos(11°)}}$$

12) Velocity of Fluid given Thrust Parallel to Jet

Open Calculator

fx $$v_{jet} = \sqrt{\frac{F_X \cdot [g]}{\gamma_f \cdot A_{Jet} \cdot (\sin(\angle D))^2}}$$

ex $$15.27694\text{m/s} = \sqrt{\frac{10.2\text{kN} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (\sin(11°))^2}}$$

Flat Plate Normal to the Jet

13) Area of Cross Section of Jet for Force Exerted by Stationary Plate on Jet

Open Calculator

$$A_{Jet} = \frac{F_{St,\perp p} \cdot [g]}{\gamma_f \cdot v_{jet}^2}$$

ex
$$1.200979\text{m}^2 = \frac{173\text{N} \cdot [g]}{9.81\text{kN/m}^3 \cdot (12\text{m/s})^2}$$

14) Area of Cross Section of Jet given Mass of Fluid

Open Calculator

$$A_{Jet} = \frac{m_{pS} \cdot [g]}{\gamma_f \cdot v_{jet}}$$

ex
$$1.19959\text{m}^2 = \frac{14.4\text{kg/s} \cdot [g]}{9.81\text{kN/m}^3 \cdot 12\text{m/s}}$$

15) Force Exerted by Stationary Plate on Jet

Open Calculator

$$F_{St,\perp p} = \frac{\gamma_f \cdot A_{Jet} \cdot \left(v_{jet}^2\right)}{[g]}$$

ex
$$172.859\text{N} = \frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot \left((12\text{m/s})^2\right)}{[g]}$$

16) Mass Flow Rate of Fluid Striking Plate

Open Calculator

fx $$m_{pS} = \frac{\gamma_f \cdot A_{Jet} \cdot v_{jet}}{[g]}$$

ex $$14.40492\text{kg/s} = \frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot 12\text{m/s}}{[g]}$$

17) Velocity for Force Exerted by Stationary Plate on Jet

Open Calculator

fx $$v_{jet} = \sqrt{\frac{F_{St,\perp p} \cdot [g]}{\gamma_f \cdot A_{Jet}}}$$

ex $$12.00489\text{m/s} = \sqrt{\frac{173\text{N} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2}}$$

18) Velocity given Mass of Fluid

Open Calculator

fx $$v_{jet} = \frac{m_{pS} \cdot [g]}{\gamma_f \cdot A_{Jet}}$$

ex $$11.9959\text{m/s} = \frac{14.4\text{kg/s} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2}$$

Jet Striking a Symmetrical Stationary Curved Vane at the Centre

19) Cross Sectional Area for Force Exerted on Plate in Direction of Flow of Jet

Open Calculator

fx $$A_{Jet} = \frac{F_{jet} \cdot [g]}{\gamma_f \cdot v_{jet}^2 \cdot (1 + \cos(\theta_t))}$$

ex $$1.196157\text{m}^2 = \frac{320\text{N} \cdot [g]}{9.81\text{kN/m}^3 \cdot (12\text{m/s})^2 \cdot (1 + \cos(31°))}$$

20) Force Exerted on Plate in Direction of Flow of Jet on Stationary Curved Vane

Open Calculator

fx $$F_{jet} = \left(\frac{\gamma_f \cdot A_{Jet} \cdot v_{jet}^2}{[g]} \right) \cdot (1 + \cos(\theta_t))$$

ex $$321.0281\text{N} = \left(\frac{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (12\text{m/s})^2}{[g]} \right) \cdot (1 + \cos(31°))$$

21) Force Exerted on Plate in Direction of Flow of Jet when Theta is Zero

Open Calculator

fx $$F_{jet} = \frac{2 \cdot \gamma_f \cdot A_{Jet} \cdot v_{jet}^2}{[g]}$$

ex $$345.7181\text{N} = \frac{2 \cdot 9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (12\text{m/s})^2}{[g]}$$

22) Velocity for Force Exerted on Plate in Direction of Flow of Jet

Open Calculator

fx $$v_{jet} = \sqrt{\frac{F_{jet} \cdot [g]}{\gamma_f \cdot A_{Jet} \cdot (1 + \cos(\theta_t))}}$$

ex $$11.98077\text{m/s} = \sqrt{\frac{320\text{N} \cdot [g]}{9.81\text{kN/m}^3 \cdot 1.2\text{m}^2 \cdot (1 + \cos(31°))}}$$

Variables Used

- $\angle D$ Angle between Jet and Plate *(Degree)*
- A_{Jet} Cross Sectional Area of Jet *(Square Meter)*
- F_{jet} Force on Plate in Dir of Jet on Stat Curved Vane *(Newton)*
- F_p Force Exerted by Jet Normal to Plate *(Kilonewton)*
- $F_{St,\perp p}$ Force by Stationary Plate on Jet ⊥ Plate *(Newton)*
- F_X Force by Jet Normal to Plate in X *(Kilonewton)*
- F_Y Force by Jet Normal to Plate in Y *(Kilonewton)*
- m_{pS} Mass Flow Rate of Jet *(Kilogram per Second)*
- Q Discharge by Jet *(Cubic Meter per Second)*
- $Q_{x,y}$ Discharge in any Direction *(Cubic Meter per Second)*
- v_{jet} Fluid Jet Velocity *(Meter per Second)*
- γ_f Specific Weight of Liquid *(Kilonewton per Cubic Meter)*
- θ_t Half of Angle Between Two Tangent to Vane *(Degree)*

Constants, Functions, Measurements used

- Constant: **[g]**, 9.80665
  Gravitational acceleration on Earth
- Function: **cos**, cos(Angle)
  Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- Function: **sin**, sin(Angle)
  Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.
- 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: **Area** in Square Meter (m^2)
  Area Unit Conversion
- Measurement: **Speed** in Meter per Second (m/s)
  Speed Unit Conversion
- Measurement: **Force** in Kilonewton (kN), Newton (N)
  Force Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Mass Flow Rate** in Kilogram per Second (kg/s)
  Mass Flow Rate Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m^3)
  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**
- **Force Exerted by Fluid Jet on Stationary Flat Plate Formulas**