# Important Torque Exerted on a Wheel with Radial **Curved Vanes Formulas PDF**



**Formulas Examples** with Units

# List of 50

Important Torque Exerted on a Wheel with Radial **Curved Vanes Formulas** 

Evaluate Formula (

Evaluate Formula

Evaluate Formula

Evaluate Formula 🕝

Evaluate Formula (

### 1) Angular Momentum at Inlet Formula 🕝

Formula

$$L = \left(\frac{w_f \cdot v_f}{G}\right) \cdot r$$

Example with Units

$$L = \left(\frac{w_f \cdot v_f}{G}\right) \cdot r \qquad 148.32 \, \text{kg*m²/s} = \left(\frac{12.36 \, \text{N} \cdot 40 \, \text{m/s}}{10}\right) \cdot 3 \, \text{m}$$

# 2) Angular Momentum at Outlet Formula 🕝

$$L = \left(\frac{\mathbf{w}_{\mathbf{f}} \cdot \mathbf{v}}{\mathbf{G}}\right) \cdot \mathbf{r}$$

$$L = \left(\frac{w_f \cdot v}{G}\right) \cdot r \qquad 35.9305 \, kg^* m^2 / s = \left(\frac{12.36 \, N \cdot 9.69 \, m / s}{10}\right) \cdot 3 \, m$$

3) Angular Velocity for Work Done on Wheel per Second Formula 🕝

$$\omega = \frac{\mathbf{w} \cdot \mathbf{G}}{\mathbf{w}_{\mathbf{f}} \cdot \left(\mathbf{v}_{\mathbf{f}} \cdot \mathbf{r} + \mathbf{v} \cdot \mathbf{r}_{\mathbf{0}}\right)}$$

Example with Units

$$\omega = \frac{w \cdot G}{w_f \cdot (v_f \cdot r + v \cdot r_0)}$$
 
$$13.3542_{\text{rad/s}} = \frac{3.9 \,\text{kJ} \cdot 10}{12.36 \,\text{N} \cdot (40 \,\text{m/s} \cdot 3 \,\text{m} + 9.69 \,\text{m/s} \cdot 12 \,\text{m})}$$

# 4) Efficiency of System Formula C

$$\eta = \left(1 - \left(\frac{\mathbf{v}}{\mathbf{v}_{\mathbf{f}}}\right)^{2}\right)$$

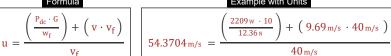
Example with Units

$$\eta = \left(1 - \left(\frac{v}{v_f}\right)^2\right) \qquad 0.9413 = \left(1 - \left(\frac{9.69 \,\text{m/s}}{40 \,\text{m/s}}\right)^2\right)$$

# 5) Initial Velocity for Work Done if Jet leaves in Motion of Wheel Formula 🕝

$$u = \frac{\left(\frac{P_{dc} \cdot G}{w_f}\right) + \left(v \cdot v_f\right)}{v_f}$$

Example with Units



# 6) Initial Velocity given Power Delivered to Wheel Formula C

Formula

Evaluate Formula (

 $u = \left( \left( \frac{P_{dc} \cdot G}{w_f \cdot v_f} \right) - \left( v \right) \right) \left| \right| 34.9904 \, \text{m/s} = \left( \left( \frac{2209 \, \text{w} \cdot 10}{12.36 \, \text{N} \cdot 40 \, \text{m/s}} \right) - \left( 9.69 \, \text{m/s} \right) \right) \right|$ 

# 7) Initial Velocity when Work Done at Vane Angle is 90 and Velocity is Zero Formula 🕝

Example with Units  Evaluate Formula (

8) Mass of Fluid Striking Vane per Second Formula

 $m_f = \frac{w_f}{G}$  1.236 kg =  $\frac{12.36 \,\text{N}}{10}$ 

Evaluate Formula

9) Power Delivered to Wheel Formula

 $P_{dc} = \left(\frac{w_f}{G}\right) \cdot \left(v_f \cdot u + v \cdot v_f\right)$ 

Evaluate Formula (

Example with Units

$$2209.4736 w = \left(\frac{12.36 N}{10}\right) \cdot \left(40 m/s \cdot 35 m/s + 9.69 m/s \cdot 40 m/s\right)$$

# 10) Radius at Inlet for Work Done on Wheel per Second Formula 🗂

 $r = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - \left(v \cdot r_0\right)}{3.161 \, \text{m}} = \frac{\left(\frac{3.9 \, \text{kJ} \cdot 10}{12.36 \, \text{N} \cdot 13 \, \text{rad/s}}\right) - \left(9.69 \, \text{m/s} \cdot 12 \, \text{m}\right)}{40.61 \, \text{m}}$ 

Evaluate Formula (

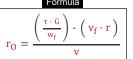
# 11) Radius at Inlet with Known Torque by Fluid Formula C

Formula

Evaluate Formula (

 $r = \frac{\left(\frac{\tau \cdot G}{w_f}\right) + \left(\tau \cdot r_0\right)}{v_f} \left| \quad 8.8131_m \right. = \frac{\left(\frac{292\,\text{N}^*\text{m}}{12.36\,\text{N}}\right) + \left(9.69\,\text{m/s}\,\cdot 12_m\right)}{40\,\text{m/s}}$ 

# 12) Radius at Outlet for Torque Exerted by Fluid Formula 🕝





### Evaluate Formula (

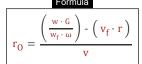
Evaluate Formula

Evaluate Formula [

Evaluate Formula [

Evaluate Formula

# 13) Radius at Outlet for Work Done on Wheel per Second Formula 🕝



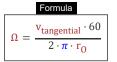
Formula Example with Units 
$$r_0 = \frac{\left(\frac{w \cdot G}{w_f \cdot \omega}\right) - \left(v_f \cdot r\right)}{v} \qquad 12.6644_m = \frac{\left(\frac{3.9 \, \text{kJ} \cdot 10}{12.36 \, \text{N} \cdot 13 \, \text{rad/s}}\right) - \left(40 \, \text{m/s} \cdot 3 \, \text{m}\right)}{9.69 \, \text{m/s}}$$

# 14) Speed of Wheel given Tangential Velocity at Inlet Tip of Vane Formula 🕝

$$\Omega = \frac{\mathbf{v}_{\text{tangential}} \cdot 60}{2 \cdot \pi \cdot \mathbf{r}}$$

Formula Example with Units 
$$\Omega = \frac{v_{tangential} \cdot 60}{2 \cdot \pi \cdot r}$$
 
$$3.1831_{rev/s} = \frac{60 \text{ m/s} \cdot 60}{2 \cdot 3.1416 \cdot 3 \text{ m}}$$

# 15) Speed of Wheel given Tangential Velocity at Outlet Tip of Vane Formula C





# 16) Torque Exerted by Fluid Formula C

$$\tau = \left(\frac{\mathbf{w}_f}{\mathbf{G}}\right) \cdot \left(\mathbf{v}_f \cdot \mathbf{r} + \mathbf{v} \cdot \mathbf{r}_0\right)$$

Example with Units
$$292.0421 \,\text{N*m} = \left(\frac{12.36 \,\text{N}}{10}\right) \cdot \left(40 \,\text{m/s} \cdot 3 \,\text{m} + 9.69 \,\text{m/s} \cdot 12 \,\text{m}\right)$$

# 17) Velocity at Point given Efficiency of System Formula 🕝

Formula Example with Units 
$$v = \sqrt{1 - \eta} \cdot v_f \qquad 17.8885 \, \text{m/s} = \sqrt{1 - 0.80 \cdot 40 \, \text{m/s}}$$

# 18) Velocity for Work Done if there is no Loss of Energy Formula 🕝

Formula 
$$\mathbf{v_f} = \left( \frac{\mathbf{w} \cdot 2 \cdot \mathbf{G}}{\mathbf{v} \cdot 2 \cdot \mathbf{G}} \right)$$

Evaluate Formula (

$$r_{\rm f} = \sqrt{\left(\frac{{\rm w} \cdot 2 \cdot {\rm G}}{{\rm w}_{\rm f}}\right) + {\rm v}^2}$$

$$v_{f} = \sqrt{\left(\frac{w \cdot 2 \cdot G}{w_{f}}\right) + v^{2}} = \sqrt{\left(\frac{3.9 \, \text{kJ} \cdot 2 \cdot 10}{12.36 \, \text{N}}\right) + 9.69 \, \text{m/s}^{2}}$$

# 19) Velocity given Angular Momentum at Inlet Formula 🕝

# Formula

Evaluate Formula

$$v_f = \frac{L \cdot G}{w_f \cdot r}$$
 67.4218 m/s =  $\frac{250 \text{ kg*m}^2/\text{s} \cdot 10}{12.36 \text{ N} \cdot 3 \text{ m}}$ 

### 20) Velocity given Angular Momentum at Outlet Formula C

Formula 
$$T_m \cdot G$$

Formula Example with Units 
$$v = \frac{T_m \cdot G}{w_f \cdot r} \qquad 10.383 \, \text{m/s} = \frac{38.5 \, \text{kg*m/s} \, \cdot 10}{12.36 \, \text{N} \, \cdot 3 \, \text{m}}$$

### Evaluate Formula (

# 21) Velocity given Efficiency of System Formula



Formula Example with Units 
$$v_f = \frac{v}{\sqrt{1 - \eta}} \qquad 21.6675 \, \text{m/s} = \frac{9.69 \, \text{m/s}}{\sqrt{1 - 0.80}}$$

# Evaluate Formula

# 22) Radius of the Wheel Formulas (

# 22.1) Radius of Wheel for Tangential Velocity at Inlet Tip of Vane Formula 🗂

Formula 
$$r = \frac{v}{\frac{2 \cdot \pi \cdot \Omega}{60}}$$

Evaluate Formula

# 22.2) Radius of Wheel for Tangential Velocity at Outlet Tip of Vane Formula 🕝

Formula Example with Units 
$$r = \frac{v_{tangential}}{\frac{2 \cdot \pi \cdot \Omega}{60}} = \frac{4.5473 \, \text{m}}{\frac{2 \cdot 3.1416 \cdot 2.1 \, \text{rev/s}}{60}}$$

Evaluate Formula

# 22.3) Radius of Wheel given Angular Momentum at Inlet Formula C

Formula Example with Units 
$$r = \frac{L}{\frac{w_f \cdot v_f}{G}} \qquad 5.0566 \, \mathrm{m} = \frac{250 \, \mathrm{kg^*m^2/s}}{\frac{12.36 \, \mathrm{N} \cdot 40 \, \mathrm{m/s}}{2000 \, \mathrm{m}}}$$

Evaluate Formula

# 23) Tangential momentum and Tangential velocity Formulas 🕝

# 23.1) Tangential Momentum of Fluid Striking Vanes at Inlet Formula 🕝

Formula
$$T_{m} = \frac{w_{f} \cdot v_{f}}{G}$$

Formula Example with Units 
$$T_m = \frac{w_f \cdot v_f}{G} \qquad 49.44 \, \text{kg*m/s} \, = \frac{12.36 \, \text{N} \, \cdot 40 \, \text{m/s}}{10}$$

Evaluate Formula (

# 23.2) Tangential Momentum of Fluid Striking Vanes at Outlet Formula [7]

$$T_{\rm m} = \frac{w_{\rm f} \cdot v}{G} \qquad 11.9768 \, \text{kg*m/s} = \frac{12.36 \, \text{N} \cdot 9.69 \, \text{m/s}}{10}$$

# Evaluate Formula

# 23.3) Tangential Velocity at Inlet Tip of Vane Formula C

Formula 
$$v_{\text{tangential}} = \left(\frac{2 \cdot \pi \cdot \Omega}{60}\right) \cdot r$$



Evaluate Formula 🕝

# 23.4) Tangential Velocity at Outlet Tip of Vane Formula

$$\mathbf{v}_{\text{tangential}} = \left(\frac{2 \cdot \pi \cdot \Omega}{60}\right) \cdot \mathbf{r}$$



Evaluate Formula (

# 23.5) Velocity given Tangential Momentum of Fluid Striking Vanes at Inlet Formula 🕝



$$u = \frac{T_m \cdot G}{w_f}$$

$$31.1489 \, \text{m/s} = \frac{38.5 \, \text{kg} \cdot \text{m/s} \cdot 10}{12.36 \, \text{N}}$$

Evaluate Formula (

# 23.6) Velocity given Tangential Momentum of Fluid Striking Vanes at Outlet Formula C

$$u = \frac{T_m \cdot G}{w_f}$$

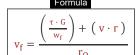
Formula Example with Units 
$$u = \frac{T_m \cdot G}{w_f} \qquad 31.1489 \, \text{m/s} = \frac{38.5 \, \text{kg*m/s} \, \cdot 10}{12.36 \, \text{N}}$$

Evaluate Formula

Evaluate Formula (

# 24) Velocity at Inlet Formulas (

# 24.1) Velocity at Inlet given Torque by Fluid Formula [



Formula Example with Units 
$$v_f = \frac{\left(\frac{\tau \cdot G}{w_f}\right) + \left(v \cdot r\right)}{r_0} \qquad 22.1097 \, \text{m/s} = \frac{\left(\frac{292 \, \text{N*m} \cdot 10}{12.36 \, \text{N}}\right) + \left(9.69 \, \text{m/s} \cdot 3 \, \text{m}\right)}{12 \, \text{m}}$$

# 24.2) Velocity at Inlet given Work Done on Wheel Formula 🕝

Evaluate Formula (

Evaluate Formula

Evaluate Formula

Evaluate Formula 🕝

$$v_{f} = \frac{\left(\frac{w \cdot g}{w_{f} \cdot \omega}\right) - v \cdot r_{0}}{r}$$

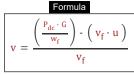
$$42.1461 \text{ m/s} = \frac{\left(\frac{3}{12.36}\right)}{r}$$

### 24.3) Velocity at Inlet when Work Done at Vane Angle is 90 and Velocity is Zero Formula 🕝 Evaluate Formula (

Formula Example with Units 
$$v_f = \frac{w \cdot G}{w_f \cdot u} \quad 90.1526 \, \text{m/s} = \frac{3.9 \, \text{kJ} \cdot 10}{12.36 \, \text{N} \cdot 35 \, \text{m/s}}$$

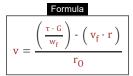
# 25) Velocity at Outlet Formulas 🕝

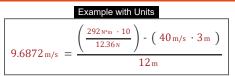
# 25.1) Velocity at Outlet given Power Delivered to Wheel Formula 🕝



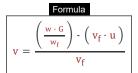
9.6804 m/s = 
$$\frac{\left(\frac{2209 \text{ w} \cdot 10}{12.36 \text{ N}}\right) - \left(40 \text{ m/s} \cdot 35 \text{ m/s}\right)}{40 \text{ m/s}}$$

# 25.2) Velocity at Outlet given Torque by Fluid Formula 🕝





# 25.3) Velocity at Outlet given Work Done if Jet leaves in Motion of Wheel Formula C



Example with Units 
$$43.8835\,\text{m/s} \,=\, \frac{\left(\frac{3.9\,\text{kJ}\,\cdot\,10}{12.36\,\text{N}}\right) - \left(\,40\,\text{m/s}\,\cdot\,35\,\text{m/s}\,\,\right)}{40\,\text{m/s}}$$

# 25.4) Velocity at Outlet given Work Done on Wheel Formula C

# Formula

$$10.2265\,\text{m/s} \,=\, \frac{\left(\frac{3.9\,\text{kj}\,\cdot\,10}{12.36\,\text{N}\,\cdot\,13\,\text{rad/s}}\right) - \left(\,40\,\text{m/s}\,\cdot\,3\,\text{m}\,\right.}{12\,\text{m}}$$

# 26) Weight of the Fluid Formulas (

### 26.1) Weight of Fluid for Work Done if there is no loss of Energy Formula 🕝

Example with Units  $w_{f} = \frac{w \cdot 2 \cdot G}{v_{f}^{2} - v^{2}} \left| 51.7893 \, N \right| = \frac{3.9 \, \text{KJ} \cdot 2 \cdot 10}{40 \, \text{m/s}^{2} - 9.69 \, \text{m/s}^{2}}$  Evaluate Formula (

Evaluate Formula

Evaluate Formula (

Evaluate Formula (

# 26.2) Weight of Fluid for Work Done on Wheel per Second Formula 🕝

Example with Units  $w_{f} = \frac{w \cdot G}{\left(v_{f} \cdot r + v \cdot r_{0}\right) \cdot \omega} \left| \quad | \quad 12.6968 \, N \right| = \frac{3.9 \, \text{kJ} \cdot 10}{\left(40 \, \text{m/s} \cdot 3 \, \text{m} \right. + 9.69 \, \text{m/s} \cdot 12 \, \text{m} \left. \right) \cdot 13 \, \text{rad/s}}$ 

# 26.3) Weight of Fluid given Angular Momentum at Inlet Formula 🕝

 $|| w_f = \frac{L \cdot G}{v_f \cdot r} || || 20.8333 \, \text{N} = \frac{250 \, \text{kg*m²/s} \cdot 10}{40 \, \text{m/s} \cdot 3 \, \text{m}} ||$ 

### 26.4) Weight of Fluid given Angular Momentum at Outlet Formula 🕝

 $w_f = \frac{T_m \cdot G}{v \cdot r_0}$  91.9788 N =  $\frac{38.5 \, kg^* m/s \cdot 10}{9.69 \, m/s \cdot 12 \, m}$ 

26.5) Weight of Fluid given Mass of Fluid Striking Vane per Second Formula 🕝

Evaluate Formula (

### 26.6) Weight of Fluid given Power Delivered to Wheel Formula C

Formula

Example with Units  $w_f = \frac{P_{dc} \cdot G}{v_f \cdot u + v \cdot v_f} \quad | \quad | \quad 12.3574_N = \frac{2209_W \cdot 10}{40_{\,\text{m/s}} \cdot 35_{\,\text{m/s}} + 9.69_{\,\text{m/s}} \cdot 40_{\,\text{m/s}}}$  Evaluate Formula

# 26.7) Weight of Fluid given Tangential Momentum of Fluid Striking Vanes at Inlet Formula 🕝

 $w_f = \frac{T_m \cdot G}{v_c}$  9.625 N =  $\frac{38.5 \,\text{kg*m/s} \cdot 10}{40 \,\text{m/s}}$ 

Evaluate Formula

# 26.8) Weight of Fluid given Work Done if Jet leaves in Motion of Wheel Formula 🕝

$$w_f = \frac{w \cdot G}{}$$

Example with Units

Evaluate Formula (

Evaluate Formula

Evaluate Formula (

Evaluate Formula

Evaluate Formula 🕝

$$w_f = \frac{w \cdot G}{v_f \cdot u \cdot v \cdot v_f}$$

 $w_f = \frac{w \cdot G}{v_f \cdot u - v \cdot v_f}$  38.5223 N =  $\frac{3.9 \text{ KJ} \cdot 10}{40 \text{ m/s} \cdot 35 \text{ m/s} - 9.69 \text{ m/s} \cdot 40 \text{ m/s}}$ 

26.9) Weight of Fluid when Work Done at Vane Angle is 90 and Velocity is Zero Formula (

 $w_f = \frac{w \cdot G}{v_f \cdot u}$   $27.8571 \text{ N} = \frac{3.9 \text{ KJ} \cdot 10}{40 \text{ m/s} \cdot 35 \text{ m/s}}$ 

Example with Units

# 27) Work Done Formulas

27.1) Work Done for Radial Discharge at Vane Angle is 90 and Velocity is Zero Formula 🕝

Formula

Example with Units  $w = \left(\frac{w_f}{G}\right) \cdot \left(v_f \cdot u\right) \ \left| \ \underbrace{\left[ \ 1.7304 \, \text{kg} \ = \left(\frac{12.36 \, \text{N}}{10}\right) \cdot \left(\ 40 \, \text{m/s} \, \cdot 35 \, \text{m/s} \ \right) \ \right|}_{} \right.$ 

27.2) Work Done if Jet leaves in Direction as that of Motion of Wheel Formula C

Example with Units

$$1.2513\,\text{KJ} = \left(\frac{12.36\,\text{N}}{10}\right) \cdot \left(40\,\text{m/s} \cdot 35\,\text{m/s} - 9.69\,\text{m/s} \cdot 40\,\text{m/s}\right)$$

27.3) Work Done if there is no Loss of Energy Formula C

Formula

Example with Units

 $w = \left(\frac{w_f}{2} \cdot G\right) \cdot \left(\left.v_f^{\ 2} - v^{\ 2}\right) \ \right| \ \left| \ 0.0931 \, \text{kg} \ = \left(\frac{12.36 \, \text{N}}{2} \cdot 10\right) \cdot \left(\left.40 \, \text{m/s}^{\ 2} - 9.69 \, \text{m/s}^{\ 2}\right) \right|$ 

### 27.4) Work Done on Wheel per Second Formula 🕝

Evaluate Formula 🕝

Formula

$$\mathbf{w} = \left(\frac{\mathbf{w}_{f}}{\mathbf{G}}\right) \cdot \left(\mathbf{v}_{f} \cdot \mathbf{r} + \mathbf{v} \cdot \mathbf{r}_{0}\right) \cdot \mathbf{\omega}$$

Example with Units

$$3.7965\, \text{KJ} \; = \left(\frac{12.36\,\text{N}}{10}\right) \cdot \left(\; 40\,\text{m/s}\, \cdot 3\,\text{m} \; + \; 9.69\,\text{m/s}\, \cdot 12\,\text{m}\; \right) \cdot 13\,\text{rad/s}$$

# Variables used in list of Torque Exerted on a Wheel with Radial Curved Vanes Formulas above

- G Specific Gravity of Fluid
- L Angular Momentum (Kilogram Square Meter per Second)
- m<sub>f</sub> Fluid Mass (Kilogram)
- P<sub>dc</sub> Power Delivered (Watt)
- r Radius of wheel (Meter)
- r<sub>O</sub> Radius of Outlet (Meter)
- T<sub>m</sub> Tangential Momentum (Kilogram Meter per Second)
- **u** Initial Velocity (Meter per Second)
- V Velocity of Jet (Meter per Second)
- V<sub>f</sub> Final Velocity (Meter per Second)
- V<sub>tangential</sub> Tangential Velocity (Meter per Second)
- w Work Done (Kilojoule)
- W<sub>f</sub> Weight of Fluid (Newton)
- n Efficiency of Jet
- T Torque Exerted on Wheel (Newton Meter)
- ω Angular Velocity (Radian per Second)
- **Ω** Angular Speed (Revolution per Second)

# Constants, Functions, Measurements used in list of Torque Exerted on a Wheel with Radial Curved Vanes Formulas above

- constant(s): pi,
   3.14159265358979323846264338327950288
   Archimedes' constant
- 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: Length in Meter (m)
  Length Unit Conversion
- Measurement: Weight in Kilogram (kg)
   Weight Unit Conversion
- Measurement: Speed in Meter per Second (m/s)
   Speed Unit Conversion
- Measurement: Energy in Kilojoule (KJ)
   Energy Unit Conversion
- Measurement: Power in Watt (W)

  Power Unit Conversion
- Measurement: Force in Newton (N)
   Force Unit Conversion
- Measurement: Angular Velocity in Radian per Second (rad/s), Revolution per Second (rev/s)
   Angular Velocity Unit Conversion
- Measurement: Torque in Newton Meter (N\*m)
   Torque Unit Conversion
- Measurement: Angular Momentum in Kilogram Square Meter per Second (kg\*m²/s)
   Angular Momentum Unit Conversion
- Measurement: Momentum in Kilogram Meter per Second (kg\*m/s)
   Momentum Unit Conversion

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 with Radial Curved Vanes Formulas

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