

# Important Calculation of Forces on Ocean Structures Formulas PDF



**Formulas  
Examples  
with Units**

## List of 17 Important Calculation of Forces on Ocean Structures Formulas

### 1) The Keulegan-Carpenter Number Formulas

#### 1.1) Amplitude of Flow Velocity Oscillation Formula

Formula

$$V_{fv} = \frac{K_C \cdot L}{T}$$

Example with Units

$$3.871 \text{ m/s} = \frac{8 \cdot 30 \text{ m}}{62 \text{ s}}$$

Evaluate Formula 

#### 1.2) Amplitude of Flow Velocity Oscillation for Sinusoidal Motion of Fluid Formula

Formula

$$V_{fv} = \frac{A \cdot 2 \cdot \pi}{T}$$

Example with Units

$$4.0537 \text{ m/s} = \frac{40 \cdot 2 \cdot 3.1416}{62 \text{ s}}$$

Evaluate Formula 

#### 1.3) Characteristic Length Scale of Object Formula

Formula

$$L = \frac{V_{fv} \cdot T}{K_C}$$

Example with Units

$$31 \text{ m} = \frac{4 \text{ m/s} \cdot 62 \text{ s}}{8}$$

Evaluate Formula 

#### 1.4) Characteristic Length Scale of Object given Displacement Parameter Formula

Formula

$$L = \frac{A}{\delta}$$

Example with Units

$$26.6667 \text{ m} = \frac{40}{1.5}$$

Evaluate Formula 

#### 1.5) Displacement Parameter for Sediment Transport for Sinusoidal Motion of Fluid Formula

Formula

$$\delta = \frac{K_C}{2 \cdot \pi}$$

Example

$$1.2732 = \frac{8}{2 \cdot 3.1416}$$

Evaluate Formula 



## 1.6) Displacement Parameter for Sediment Transport under Water Waves Formula

Formula

$$\delta = \frac{A}{L}$$

Example with Units

$$1.3333 = \frac{40}{30\text{m}}$$

Evaluate Formula 

## 1.7) Excursion Amplitude of Fluid Particles in Oscillatory Flow given Displacement Parameter Formula

Formula

$$A = \delta \cdot L$$

Example with Units

$$45 = 1.5 \cdot 30\text{m}$$

Evaluate Formula 

## 1.8) Keulegan-Carpenter Number Formula

Formula

$$K_C = \frac{V_{fv} \cdot T}{L}$$

Example with Units

$$8.2667 = \frac{4\text{m/s} \cdot 62\text{s}}{30\text{m}}$$

Evaluate Formula 

## 1.9) Keulegan-Carpenter Number for Sinusoidal Motion of Fluid Formula

Formula

$$K_C = 2 \cdot \pi \cdot \delta$$

Example

$$9.4248 = 2 \cdot 3.1416 \cdot 1.5$$

Evaluate Formula 

## 1.10) Period of Oscillation Formula

Formula

$$T = \frac{K_C \cdot L}{V_{fv}}$$

Example with Units

$$60\text{s} = \frac{8 \cdot 30\text{m}}{4\text{m/s}}$$

Evaluate Formula 

## 1.11) Period of Oscillation for Sinusoidal Motion of Fluid Formula

Formula

$$T = \frac{A \cdot 2 \cdot \pi}{V_{fv}}$$

Example with Units

$$62.8319\text{s} = \frac{40 \cdot 2 \cdot 3.1416}{4\text{m/s}}$$

Evaluate Formula 

## 2) The Morison (MOJS) Equation Formulas

### 2.1) Added-Mass Coefficient for Fixed Body in Oscillatory Flow Formula

Formula

$$C_a = C_m - 1$$

Example

$$4 = 5 - 1$$

Evaluate Formula 

### 2.2) Drag Force for Fixed body in Oscillatory Flow Formula

Formula

$$F_D = 0.5 \cdot \rho_{\text{Fluid}} \cdot C_D \cdot S \cdot V_f^2$$

Example with Units

$$0.1029\text{kN} = 0.5 \cdot 1.225\text{kg/m}^3 \cdot 0.30 \cdot 5.08\text{m}^2 \cdot 10.5\text{m/s}^2$$

Evaluate Formula 



### 2.3) Froude-Krylov Force Formula

Formula

$$F_k = \rho_{\text{Fluid}} \cdot V \cdot u'$$

Example with Units

$$6.125 \text{ kN} = 1.225 \text{ kg/m}^3 \cdot 50 \text{ m}^3 \cdot 100 \text{ m}^3/\text{s}$$

Evaluate Formula 

### 2.4) Hydrodynamic Mass Force Formula

Formula

$$F = \rho_{\text{Fluid}} \cdot C_a \cdot V \cdot u'$$

Example with Units

$$27.5625 \text{ kN} = 1.225 \text{ kg/m}^3 \cdot 4.5 \cdot 50 \text{ m}^3 \cdot 100 \text{ m}^3/\text{s}$$

Evaluate Formula 

### 2.5) Inertia Coefficient for Fixed body in Oscillatory Flow Formula

Formula

$$C_m = 1 + C_a$$

Example

$$5.5 = 1 + 4.5$$

Evaluate Formula 

### 2.6) Inertia Force for Fixed body in Oscillatory Flow Formula

Formula

$$F_i = \rho_{\text{Fluid}} \cdot C_m \cdot V \cdot u'$$

Example with Units

$$30.625 \text{ kN} = 1.225 \text{ kg/m}^3 \cdot 5 \cdot 50 \text{ m}^3 \cdot 100 \text{ m}^3/\text{s}$$









Evaluate Formula 



## Variables used in list of Calculation of Forces on Ocean Structures Formulas above










- **A** Excursion Amplitude of Fluid Particles
- **C<sub>a</sub>** Added Mass Coefficient
- **C<sub>D</sub>** Drag Coefficient of Fluid
- **C<sub>m</sub>** Inertia Coefficient
- **F** Hydrodynamic Mass Force (Kilonewton)
- **F<sub>D</sub>** Drag Force (Kilonewton)
- **F<sub>i</sub>** Inertia Force of Fluid (Kilonewton)
- **F<sub>k</sub>** Froude-Krylov Force (Kilonewton)
- **K<sub>C</sub>** Keulegan-Carpenter Number
- **L** Length Scale (Meter)
- **S** Reference Area (Square Meter)
- **T** Time Period of Oscillations (Second)
- **u'** Flow Acceleration (Cubic Meter per Second)
- **V** Volume of Body (Cubic Meter)
- **V<sub>f</sub>** Flow Velocity (Meter per Second)
- **V<sub>fv</sub>** Amplitude of Flow Velocity Oscillation (Meter per Second)
- **δ** Displacement Parameter
- **ρ<sub>Fluid</sub>** Density of Fluid (Kilogram per Cubic Meter)

## Constants, Functions, Measurements used in list of Calculation of Forces on Ocean Structures Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288  
*Archimedes' constant*
- **Measurement: Length** in Meter (m)  
*Length Unit Conversion* 
- **Measurement: Time** in Second (s)  
*Time Unit Conversion* 
- **Measurement: Volume** in Cubic Meter (m<sup>3</sup>)  
*Volume Unit Conversion* 
- **Measurement: Area** in Square Meter (m<sup>2</sup>)  
*Area Unit Conversion* 
- **Measurement: Speed** in Meter per Second (m/s)  
*Speed Unit Conversion* 
- **Measurement: Force** in Kilonewton (kN)  
*Force Unit Conversion* 
- **Measurement: Volumetric Flow Rate** in Cubic Meter per Second (m<sup>3</sup>/s)  
*Volumetric Flow Rate Unit Conversion* 
- **Measurement: Density** in Kilogram per Cubic Meter (kg/m<sup>3</sup>)  
*Density Unit Conversion* 



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