# Important Hydrostatic Fluid Formulas PDF

Formulas
Examples
with Units

**List of 20**
**Important Hydrostatic Fluid Formulas**

## 1) Buoyancy Force Formula

Evaluate Formula

Formula

$$F_b = Y \cdot V_o$$

Example with Units

$$529740\,\text{N} = 9.81\,\text{kN/m}^3 \cdot 54\,\text{m}^3$$

## 2) Center of Buoyancy Formula

Evaluate Formula

Formula

$$B = \left(\frac{I}{V_o}\right) - M$$

Example with Units

$$-16.9712 = \left(\frac{1.125\,\text{kg·m}^2}{54\,\text{m}^3}\right) - 16.99206$$

## 3) Center of Gravity Formula

Evaluate Formula

Formula

$$G = \frac{I}{V_o \cdot (B + M)}$$

Example with Units

$$0.021 = \frac{1.125\,\text{kg·m}^2}{54\,\text{m}^3 \cdot (-16 + 16.99206)}$$

## 4) Distance between Buoyancy Point and Center of Gravity given Metacenter Height Formula

Evaluate Formula

Formula

$$B_g = \frac{I_w}{V_d} - G_m$$

Example with Units

$$1455.7143\,\text{mm} = \frac{100\,\text{kg·m}^2}{56\,\text{m}^3} - 330\,\text{mm}$$

## 5) Experimental Determination of Metacentric height Formula

Evaluate Formula

Formula

$$G_m = \frac{W' \cdot x}{(W' + W) \cdot \tan(\Theta)}$$

Example with Units

$$330.2655\,\text{mm} = \frac{43.5\,\text{kg} \cdot 38400\,\text{mm}}{(43.5\,\text{kg} + 25500\,\text{kg}) \cdot \tan(11.2°)}$$

## 6) Fluid Dynamic or Shear Viscosity Formula Formula

Evaluate Formula

Formula

$$\mu = \frac{F_a \cdot r}{A \cdot P_s}$$

Example with Units

$$37.5\,\text{P} = \frac{2500\,\text{N} \cdot 1200\,\text{mm}}{50\,\text{m}^2 \cdot 16\,\text{m/s}}$$

## 7) Force Acting in x Direction in Momentum Equation Formula

Evaluate Formula

Formula

$$F_x = \rho_l \cdot Q \cdot \left( V_1 - V_2 \cdot \cos(\theta) \right) + P_1 \cdot A_1 - \left( P_2 \cdot A_2 \cdot \cos(\theta) \right)$$

Example with Units

$$1121.5394\,\text{N} = 4\,\text{kg/m}^3 \cdot 1.1\,\text{m}^3\text{/s} \cdot \left( 20\,\text{m/s} - 12\,\text{m/s} \cdot \cos(30°) \right) + 122\,\text{Pa} \cdot 14\,\text{m}^2 - \left( 121\,\text{Pa} \cdot 6\,\text{m}^2 \cdot \cos(30°) \right)$$

## 8) Force Acting in y-Direction in Momentum Equation Formula

Evaluate Formula

Formula

$$F_y = \rho_l \cdot Q \cdot \left( - V_2 \cdot \sin(\theta) - P_2 \cdot A_2 \cdot \sin(\theta) \right)$$

Example with Units

$$-1623.6\,\text{N} = 4\,\text{kg/m}^3 \cdot 1.1\,\text{m}^3\text{/s} \cdot \left( - 12\,\text{m/s} \cdot \sin(30°) - 121\,\text{Pa} \cdot 6\,\text{m}^2 \cdot \sin(30°) \right)$$

## 9) Metacenter Formula

Evaluate Formula

Formula

$$M = \frac{I}{V_o \cdot G} - B$$

Example with Units

$$16.9921 = \frac{1.125\,\text{kg·m}^2}{54\,\text{m}^3 \cdot 0.021} - -16$$

## 10) Metacentric Height Formula

Evaluate Formula

Formula

$$G_m = B_m - B_g$$

Example with Units

$$330\,\text{mm} = 1785\,\text{mm} - 1455\,\text{mm}$$

## 11) Metacentric Height given Moment of Inertia Formula

Evaluate Formula

Formula

$$G_m = \frac{I_w}{V_d} - B_g$$

Example with Units

$$330.7143\,\text{mm} = \frac{100\,\text{kg·m}^2}{56\,\text{m}^3} - 1455\,\text{mm}$$

## 12) Moment of Inertia of Waterline Area using Metacentric Height Formula

Evaluate Formula

Formula

$$I_w = \left( G_m + B_g \right) \cdot V_d$$

Example with Units

$$99.96\,\text{kg·m}^2 = \left( 330\,\text{mm} + 1455\,\text{mm} \right) \cdot 56\,\text{m}^3$$

## 13) Pressure in Bubble Formula

Evaluate Formula

Formula

$$P = \frac{8 \cdot \sigma}{d_b}$$

Example with Units

$$7.2131\,\text{Pa} = \frac{8 \cdot 55\,\text{N/m}}{61000\,\text{mm}}$$

## 14) Radius of Gyration given Time Period of Rolling Formula

Evaluate Formula

Formula

$$K_g = \sqrt{[g] \cdot G_m \cdot \left(\frac{T}{2} \cdot \pi\right)^2}$$

Example with Units

$$29388.0334\,\text{mm} = \sqrt{9.8066\,\text{m/s}^2 \cdot 330\,\text{mm} \cdot \left(\frac{10.4\,\text{s}}{2} \cdot 3.1416\right)^2}$$

## 15) Surface Area given Surface Tension Formula

Evaluate Formula

Formula

$$A_s = \frac{E}{\sigma}$$

Example with Units

$$18.1818\,\text{m}^2 = \frac{1000\,\text{J}}{55\,\text{N/m}}$$

## 16) Surface Energy given Surface Tension Formula

Evaluate Formula

Formula

$$E = \sigma \cdot A_s$$

Example with Units

$$1000.45\,\text{J} = 55\,\text{N/m} \cdot 18.19\,\text{m}^2$$

## 17) Surface Tension given Surface Energy and Area Formula

Evaluate Formula

Formula

$$\sigma = \frac{E}{A_s}$$

Example with Units

$$54.9753\,\text{N/m} = \frac{1000\,\text{J}}{18.19\,\text{m}^2}$$

## 18) Theoretical Velocity for Pitot Tube Formula

Evaluate Formula

Formula

$$V_{th} = \sqrt{2 \cdot [g] \cdot h_d}$$

Example with Units

$$1.1291\,\text{m/s} = \sqrt{2 \cdot 9.8066\,\text{m/s}^2 \cdot 65\,\text{mm}}$$

## 19) Volume of Liquid Displaced given Metacentric Height Formula

Evaluate Formula

Formula

$$V_d = \frac{I_w}{G_m + B_g}$$

Example with Units

$$56.0224\,\text{m}^3 = \frac{100\,\text{kg·m}^2}{330\,\text{mm} + 1455\,\text{mm}}$$

## 20) Volume of Submerged Object given Buoyancy Force Formula

Evaluate Formula

Formula

$$V_o = \frac{F_b}{Y}$$

Example with Units

$$54\,\text{m}^3 = \frac{529740\,\text{N}}{9.81\,\text{kN/m}^3}$$

## Variables used in list of Hydrostatic Fluid Formulas above

- **A** Area of Solid Plates *(Square Meter)*
- $A_1$ Cross Sectional Area at Point 1 *(Square Meter)*
- $A_2$ Cross Sectional Area at Point 2 *(Square Meter)*
- $A_s$ Surface Area *(Square Meter)*
- **B** Centre of Buoyancy
- $B_g$ Distance Between Point B And G *(Millimeter)*
- $B_m$ Distance Between Point B And M *(Millimeter)*
- $d_b$ Diameter of Bubble *(Millimeter)*
- **E** Surface Energy *(Joule)*
- $F_a$ Applied Force *(Newton)*
- $F_b$ Buoyancy Force *(Newton)*
- $F_x$ Force in X Direction *(Newton)*
- $F_y$ Force in Y Direction *(Newton)*
- **G** Centre of Gravity
- $G_m$ Metacentric Height *(Millimeter)*
- $h_d$ Dynamic Pressure Head *(Millimeter)*
- **I** Moment of Inertia *(Kilogram Square Meter)*
- $I_w$ Moment of Inertia of Waterline Area *(Kilogram Square Meter)*
- $K_g$ Radius of Gyration *(Millimeter)*
- **M** Metacenter
- **P** Pressure *(Pascal)*
- $P_1$ Pressure at Section 1 *(Pascal)*
- $P_2$ Pressure at Section 2 *(Pascal)*
- $P_s$ Peripheral Speed *(Meter per Second)*
- **Q** Discharge *(Cubic Meter per Second)*
- **r** Distance Between Two Masses *(Millimeter)*
- **T** Time Period of Rolling *(Second)*
- $V_1$ Velocity at Section 1-1 *(Meter per Second)*
- $V_2$ Velocity at Section 2-2 *(Meter per Second)*

## Constants, Functions, Measurements used in list of Hydrostatic Fluid Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- constant(s): **[g]**, 9.80665 *Gravitational acceleration on Earth*
- 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: **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.*
- 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.*
- Functions: **tan**, tan(Angle) *The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.*
- Measurement: **Length** in Millimeter (mm) *Length Unit Conversion*
- Measurement: **Weight** in Kilogram (kg) *Weight Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Volume** in Cubic Meter ($m^3$) *Volume Unit Conversion*
- Measurement: **Area** in Square Meter ($m^2$) *Area Unit Conversion*
- Measurement: **Pressure** in Pascal (Pa) *Pressure Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Energy** in Joule (J) *Energy Unit Conversion*
- Measurement: **Force** in Newton (N) *Force Unit Conversion*

- $V_d$ Volume of Liquid Displaced By Body *(Cubic Meter)*
- $V_o$ Volume of Object *(Cubic Meter)*
- $V_{th}$ Theoretical Velocity *(Meter per Second)*
- **W** Ship Weight *(Kilogram)*
- **W'** Movable Weight on Ship *(Kilogram)*
- **x** Transverse Displacement *(Millimeter)*
- **Y** Specific Weight of Liquid *(Kilonewton per Cubic Meter)*
- **θ** Theta *(Degree)*
- **Θ** Angle of Tilt *(Degree)*
- **μ** Dynamic Viscosity *(Poise)*
- $\rho_l$ Density of Liquid *(Kilogram per Cubic Meter)*
- **σ** Surface Tension *(Newton per Meter)*

- 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: **Surface Tension** in Newton per Meter (N/m)
  *Surface Tension Unit Conversion*
- Measurement: **Dynamic Viscosity** in Poise (P)
  *Dynamic Viscosity Unit Conversion*
- Measurement: **Density** in Kilogram per Cubic Meter ($kg/m^3$)
  *Density Unit Conversion*
- Measurement: **Moment of Inertia** in Kilogram Square Meter ($kg \cdot m^2$)
  *Moment of Inertia Unit Conversion*
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter ($kN/m^3$)
  *Specific Weight Unit Conversion*

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