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Hydrostatic Fluid Formulas

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List of 20 Hydrostatic Fluid Formulas

Hydrostatic Fluid

1) Buoyancy Force

Open Calculator

fx $F_b = Y \cdot V_o$

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

2) Center of Buoyancy

Open Calculator

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

ex $-16.971227 = \left(\frac{1.125\text{kg·m}^2}{54\text{m}^3}\right) - 16.99206$

3) Center of Gravity

Open Calculator

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

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

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

Open Calculator

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

ex $1455.714\text{mm} = \frac{100\text{kg·m}^2}{56\text{m}^3} - 330\text{mm}$

5) Experimental Determination of Metacentric height

Open Calculator

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

ex $330.2655\text{mm} = \frac{43.5\text{kg} \cdot 38400\text{mm}}{(43.5\text{kg} + 25500\text{kg}) \cdot \tan(11.2^\circ)}$

6) Fluid Dynamic or Shear Viscosity Formula

Open Calculator

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

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

7) Force Acting in x Direction in Momentum Equation

Open Calculator

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

ex $1121.539\text{N} = 4\text{kg/m}^3 \cdot 1.1\text{m}^3\text{/s} \cdot (20\text{m/s} - 12\text{m/s} \cdot \cos(30^\circ)) + 122\text{Pa} \cdot 14\text{m}^2 - (121\text{Pa} \cdot 6\text{m}^2 \cdot \cos(30^\circ))$

8) Force Acting in y-Direction in Momentum Equation

Open Calculator

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

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

9) Metacenter

Open Calculator

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

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

10) Metacentric Height

Open Calculator

fx $G_m = B_m - B_g$

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

11) Metacentric Height given Moment of Inertia

Open Calculator

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

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

12) Moment of Inertia of Waterline Area using Metacentric Height

Open Calculator

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

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

13) Pressure in Bubble

Open Calculator

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

$$7.213115\text{Pa} = \frac{8 \cdot 55\text{N/m}}{61000\text{mm}}$$

14) Radius of Gyration given Time Period of Rolling

Open Calculator

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

$$29388.03\text{mm} = \sqrt{[g] \cdot 330\text{mm} \cdot \left(\frac{10.4\text{s}}{2} \cdot \pi\right)^2}$$

15) Surface Area given Surface Tension

Open Calculator

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

$$18.18182\text{m}^2 = \frac{1000\text{J}}{55\text{N/m}}$$

16) Surface Energy given Surface Tension

Open Calculator

$$E = \sigma \cdot A_s$$

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

17) Surface Tension given Surface Energy and Area

Open Calculator

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

$$54.97526\text{N/m} = \frac{1000\text{J}}{18.19\text{m}^2}$$

18) Theoretical Velocity for Pitot Tube

Open Calculator

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

ex $1.129099\text{m/s} = \sqrt{2 \cdot [g] \cdot 65\text{mm}}$

19) Volume of Liquid Displaced given Metacentric Height

Open Calculator

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

ex $56.02241\text{m}^3 = \frac{100\text{kg·m}^2}{330\text{mm} + 1455\text{mm}}$

20) Volume of Submerged Object given Buoyancy Force

Open Calculator

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

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

Variables Used

- **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)*
- **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)*
- **ρ_l** Density of Liquid *(Kilogram per Cubic Meter)*
- **σ** Surface Tension *(Newton per Meter)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- 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.
- Function: **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
- 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/m³)
  Density Unit Conversion
- Measurement: **Moment of Inertia** in Kilogram Square Meter (kg·m²)
  Moment of Inertia Unit Conversion
- Measurement: **Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
  Specific Weight Unit Conversion

Check other formula lists

- Fluid Force Formulas
- Fluid in Motion Formulas
- Hydrostatic Fluid Formulas
- Liquid Jet Formulas
- Pipes Formulas
- Pressure Relations Formulas
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