

Important Dredging Equipment Formulas PDF



**Formulas
Examples
with Units**

**List of 9
Important Dredging Equipment Formulas**

1) Plain Suction Dredge Formulas

1.1) Concentration of Soil in Volumetric Basis Formula

Formula

$$C_v = \frac{\gamma_m - \gamma_w}{\gamma_g - \gamma_w}$$

Example with Units

$$0.0372 \text{ m}^3 = \frac{10 \text{ kN/m}^3 - 9.807 \text{ kN/m}^3}{15 \text{ kN/m}^3 - 9.807 \text{ kN/m}^3}$$

Evaluate Formula 

1.2) Flow Velocity in Suction Pipe Formula

Formula

$$V_s = \sqrt{\left(\left(\left(p' + Z_s \right) \cdot \frac{\gamma_w}{\gamma_m} \right) - Z_s + Z_p \right) \cdot \frac{2 \cdot [g]}{F_1}}$$

Evaluate Formula 

Example with Units

$$9.0997 \text{ m/s} = \sqrt{\left(\left(\left(2.1 \text{ m} + 6 \text{ m} \right) \cdot \frac{9.807 \text{ kN/m}^3}{10 \text{ kN/m}^3} \right) - 6 \text{ m} + 6.5 \text{ m} \right) \cdot \frac{2 \cdot 9.8066 \text{ m/s}^2}{2 \text{ m}}}$$

1.3) Hydraulic Loss Coefficient from Suction Pipe Entrance to Pump Formula

Formula

$$f = \frac{\left(\left(p' + Z_s \right) \cdot \frac{\gamma_w}{\gamma_m} \right) - Z_s + Z_p}{\frac{V_s^2}{2} \cdot [g]}$$

Evaluate Formula 

Example with Units

$$0.0213 = \frac{\left(\left(2.1 \text{ m} + 6 \text{ m} \right) \cdot \frac{9.807 \text{ kN/m}^3}{10 \text{ kN/m}^3} \right) - 6 \text{ m} + 6.5 \text{ m}}{\frac{9 \text{ m/s}^2}{2} \cdot 9.8066 \text{ m/s}^2}$$



1.4) Specific Weight of Dry Sand Grains for Concentration of Soil in Volumetric Basis Formula



Formula

$$\gamma_g = \left(\frac{\gamma_m - \gamma_w}{C_v} \right) + \gamma_w$$

Example with Units

$$16.2403 \text{ kN/m}^3 = \left(\frac{10 \text{ kN/m}^3 - 9.807 \text{ kN/m}^3}{0.03 \text{ m}^3} \right) + 9.807 \text{ kN/m}^3$$

Evaluate Formula

1.5) Specific Weight of Mixture for Concentration of Soil in Volumetric Basis Formula

Formula

$$\gamma_m = C_v \cdot (\gamma_g - \gamma_w) + \gamma_w$$

Example with Units

$$9.9628 \text{ kN/m}^3 = 0.03 \text{ m}^3 \cdot (15 \text{ kN/m}^3 - 9.807 \text{ kN/m}^3) + 9.807 \text{ kN/m}^3$$

Evaluate Formula

1.6) Specific Weight of Mixture in Suction Pipe Formula

Formula

$$\gamma_m = (p' + Z_s) \cdot \frac{\gamma_w}{Z_s - Z_p + \left(f \cdot \frac{v_s^2}{2} \cdot [g] \right)}$$

Example with Units

$$10.6721 \text{ kN/m}^3 = (2.1 \text{ m} + 6 \text{ m}) \cdot \frac{9.807 \text{ kN/m}^3}{6 \text{ m} - 6.5 \text{ m} + \left(0.02 \cdot \frac{9 \text{ m/s}^2}{2} \cdot 9.8066 \text{ m/s}^2 \right)}$$

Evaluate Formula

1.7) Specific Weight of Mixture in Suction Pipe for Concentration of Soil in Volumetric Basis Formula

Formula

$$\gamma_m = C_v \cdot \gamma_g + (1 - C_v) \cdot \gamma_w$$

Example with Units

$$9.9628 \text{ kN/m}^3 = 0.03 \text{ m}^3 \cdot 15 \text{ kN/m}^3 + (1 - 0.03 \text{ m}^3) \cdot 9.807 \text{ kN/m}^3$$

Evaluate Formula



1.8) Specific Weight of Water in Suction Pipe Formula

Evaluate Formula 

Formula

$$y_w = \frac{\left(Z_s - Z_p + \left(f \cdot \frac{v_s^2}{2} \cdot [g] \right) \right) \cdot \gamma_m}{p' + Z_s}$$

Example with Units

$$9.1894 \text{ kN/m}^3 = \frac{\left(6 \text{ m} - 6.5 \text{ m} + \left(0.02 \cdot \frac{9 \text{ m/s}^2}{2} \cdot 9.8066 \text{ m/s}^2 \right) \right) \cdot 10 \text{ kN/m}^3}{2.1 \text{ m} + 6 \text{ m}}$$

1.9) Vacuum at Pump Entrance Expressed as Head of Water Formula

Evaluate Formula 

Formula

$$p' = \left(\frac{Z_s - Z_p + \left(f \cdot \frac{v_s^2}{2} \cdot [g] \right) \cdot \gamma_m}{y_w} \right) - Z_s$$

Example with Units





$$2.0997 \text{ m} = \left(\frac{6 \text{ m} - 6.5 \text{ m} + \left(0.02 \cdot \frac{9 \text{ m/s}^2}{2} \cdot 9.8066 \text{ m/s}^2 \right) \cdot 10 \text{ kN/m}^3}{9.807 \text{ kN/m}^3} \right) - 6 \text{ m}$$



Variables used in list of Dredging Equipment Formulas above











- C_v Concentration of Soil in the Mixture (Cubic Meter)
- f Hydraulic Loss Coefficient
- F_l Fetch Length (Meter)
- p' Vacuum at the Pump Entrance (Meter)
- V_s Flow Velocity in the Suction Pipe (Meter per Second)
- γ_w Specific Weight of Water (Kilonewton per Cubic Meter)
- Z_p Depth of Submergence of the Pump (Meter)
- Z_s Depth of the Suction Pipe Entrance (Meter)
- γ_g Specific Weight of Dry Sand Grains (Kilonewton per Cubic Meter)
- γ_m Specific Weight of the Mixture (Kilonewton per Cubic Meter)

Constants, Functions, Measurements used in list of Dredging Equipment Formulas above







- **constant(s):** $[g]$, 9.80665
Gravitational acceleration on Earth
- **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: Volume** in Cubic Meter (m³)
Volume Unit Conversion 
- **Measurement: Speed** in Meter per Second (m/s)
Speed Unit Conversion 
- **Measurement: Specific Weight** in Kilonewton per Cubic Meter (kN/m³)
Specific Weight Unit Conversion 



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