

# Important Structural Design Formulas PDF



**Formulas  
Examples  
with Units**

## List of 9 Important Structural Design Formulas

### 1) Allowable Bearing Pressure Formula ↻

Formula

$$f_{br} = \frac{P \cdot b}{P_t \cdot D_{rivet}}$$

Example with Units

$$21.4736 \text{ N/mm}^2 = \frac{37.7 \text{ N/mm} \cdot 1285 \text{ mm}}{94 \text{ mm} \cdot 24 \text{ mm}}$$

Evaluate Formula ↻

### 2) Average Blade Lift Coefficient Formula ↻

Formula

$$C_l = 6 \cdot \frac{C_T}{\sigma}$$

Example

$$0.4 = 6 \cdot \frac{0.04}{0.6}$$

Evaluate Formula ↻

### 3) Disk Loading Formula ↻

Formula

$$W_{load} = \frac{W_a}{\frac{\pi \cdot d_r^2}{4}}$$

Example with Units

$$5072.6473 \text{ N} = \frac{1000 \text{ N}}{\frac{3.1416 \cdot 501 \text{ mm}^2}{4}}$$

Evaluate Formula ↻

### 4) Joint Efficiency Formula ↻

Formula

$$J = \frac{b - D}{b}$$

Example with Units

$$0.9751 = \frac{1285 \text{ mm} - 32 \text{ mm}}{1285 \text{ mm}}$$

Evaluate Formula ↻

### 5) Life of Aircraft given Number of Flight Formula ↻

Formula

$$N_{flight} = \left( \frac{1}{D_{total}} \right)$$

Example

$$20 = \left( \frac{1}{0.05} \right)$$

Evaluate Formula ↻



## 6) Maximum Blade Efficiency Formula

Formula

$$n_{bm} = \frac{2 \cdot \frac{F_1}{F_d} - 1}{2 \cdot \frac{F_1}{F_d} + 1}$$

Example with Units

$$0.8207 = \frac{2 \cdot \frac{100N}{19.7N} - 1}{2 \cdot \frac{100N}{19.7N} + 1}$$

Evaluate Formula 

## 7) Shear Failure Load on Plate Formula

Formula

$$P = \frac{2 \cdot a \cdot p_t \cdot \tau_{max}}{b}$$

Example with Units

$$35.1128N/mm = \frac{2 \cdot 4mm \cdot 94mm \cdot 60N/mm^2}{1285mm}$$

Evaluate Formula 

## 8) Shear Load per width Formula

Formula

$$P = \frac{\pi \cdot (D^2) \cdot \tau_{max}}{4 \cdot b}$$

Example with Units

$$37.5524N/mm = \frac{3.1416 \cdot (32mm^2) \cdot 60N/mm^2}{4 \cdot 1285mm}$$

Evaluate Formula 

## 9) Ultimate Tensile Stress for Plate Formula

Formula

$$S_{ut} = \frac{P \cdot b}{p_t \cdot (b - D_{rivet})}$$

Example with Units

$$0.4087N/mm^2 = \frac{37.7N/mm \cdot 1285mm}{94mm \cdot (1285mm - 24mm)}$$

Evaluate Formula 



## Variables used in list of Structural Design Formulas above

- **a** Distance between Rivet and Edge of Plate (Millimeter)
- **b** Distance between Rivets (Millimeter)
- **C<sub>l</sub>** Blade Lift Coefficient
- **C<sub>T</sub>** Thrust Coefficient
- **D** Diameter (Millimeter)
- **d<sub>r</sub>** Diameter of Rotor (Millimeter)
- **D<sub>rivet</sub>** Diameter of Rivet (Millimeter)
- **D<sub>total</sub>** Total Damage per Flight
- **f<sub>br</sub>** Bearing Stress (Newton per Square Millimeter)
- **F<sub>d</sub>** Blade Drag Force (Newton)
- **F<sub>l</sub>** Blade Lift Force (Newton)
- **J** Joint Efficiency for Shell
- **n<sub>bm</sub>** Maximum Blade Efficiency
- **N<sub>flight</sub>** Number of Flights
- **P** Edge Load per Unit Width (Newton per Millimeter)
- **p<sub>t</sub>** Plate Thickness (Millimeter)
- **S<sub>ut</sub>** Ultimate Tensile Strength (Newton per Square Millimeter)
- **W<sub>a</sub>** Aircraft Weight (Newton)
- **W<sub>load</sub>** Load (Newton)
- **σ** Rotor Solidity
- **τ<sub>max</sub>** Maximum Shear Stress (Newton per Square Millimeter)

## Constants, Functions, Measurements used in list of Structural Design Formulas above

- **constant(s):** pi, 3.14159265358979323846264338327950288  
*Archimedes' constant*
- **Measurement: Length** in Millimeter (mm)  
*Length Unit Conversion* ↻
- **Measurement: Pressure** in Newton per Square Millimeter (N/mm<sup>2</sup>)  
*Pressure Unit Conversion* ↻
- **Measurement: Force** in Newton (N)  
*Force Unit Conversion* ↻
- **Measurement: Surface Tension** in Newton per Millimeter (N/mm)  
*Surface Tension Unit Conversion* ↻
- **Measurement: Stress** in Newton per Square Millimeter (N/mm<sup>2</sup>)  
*Stress Unit Conversion* ↻



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