Important Stress Concentration Factors in Design Formulas PDF



Formulas Examples with Units

List of 26

Important Stress Concentration Factors in **Design Formulas**

Evaluate Formula (

Evaluate Formula (

Evaluate Formula (

Evaluate Formula C

Evaluate Formula (

1) Rectangular Plate against Fluctuating Loads Formulas

1.1) Diameter of Transverse Hole of Rectangular Plate with Stress Concentration given Nominal Stress Formula 🕝

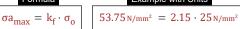


$$d_{h} = w - \frac{P}{t \cdot \sigma_{o}}$$

Example with Units

$$d_h = w - \frac{P}{t \cdot \sigma_o}$$
 35 mm = 70 mm - $\frac{8750 \,\text{N}}{10 \,\text{mm} \cdot 25 \,\text{N/mm}^2}$

1.2) Highest Value of Actual Stress near Discontinuity Formula

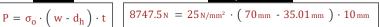


1.3) Load on Rectangular Plate with Transverse Hole given Nominal Stress Formula 🕝

Formula

$$P = \sigma_{0} \cdot (w - d_{h}) \cdot t$$

Example with Units



1.4) Nominal Tensile Stress in Rectangular Plate with Transverse Hole Formula 🕝

$$\sigma_{0} = \frac{P}{\left(w - d_{h}\right) \cdot t}$$

Example with Units

1.5) Thickness of Rectangular Plate with Transverse Hole given Nominal Stress Formula 🕝

$$t = \frac{P}{\left(w - d_h\right) \cdot \sigma_o}$$

$$t = \frac{P}{\left(w - d_h\right) \cdot \sigma_o} \left[10.0029 \,_{\text{mm}} = \frac{8750 \,_{\text{N}}}{\left(70 \,_{\text{mm}} - 35.01 \,_{\text{mm}}\right) \cdot 25 \,_{\text{N/mm}^2}} \right]$$

1.6) Width of Rectangular Plate with Transverse Hole given Nominal Stress Formula 🕝

Evaluate Formula (

$$w = \frac{P}{t \cdot \sigma_0} + d_h$$
 70.0

 $w = \frac{P}{t \cdot \sigma_0} + d_h \left| \quad 70.01 \,\text{mm} \right| = \frac{8750 \,\text{N}}{10 \,\text{mm} \cdot 25 \,\text{N/mm}^2} + 35.01 \,\text{mm}$

2) Round Shaft against Fluctuating Loads Formulas (

2.1) Bending Moment in Round Shaft with Shoulder Fillet given Nominal Stress Formula 🕝

Formula
$$\sigma_0 \cdot \pi \cdot d_{small}^3$$

Evaluate Formula (

2.2) Diameter of Shaft given Ratio of Torsional Strength of Shaft with Keyway to without Keyway Formula 🕝

Evaluate Formula (

$$d = \frac{0.2 \cdot b_k + 1.1 \cdot h}{1 \cdot C}$$

$$d = \frac{0.2 \cdot b_k + 1.1 \cdot h}{1 \cdot C}$$

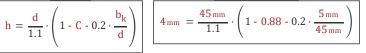
$$45_{mm} = \frac{0.2 \cdot 5_{mm} + 1.1 \cdot 4_{mm}}{1 \cdot 0.88}$$

2.3) Height of Shaft Keyway given Ratio of Torsional Strength of Shaft with Keyway to without Keyway Formula 🕝

Formula
$$h = \frac{d}{1.1} \cdot \left(1 - C - 0.2 \cdot \frac{b_k}{d} \right)$$



Evaluate Formula (



2.4) Nominal Bending Stress in Round Shaft with Shoulder Fillet Formula 🕝

$$\sigma_{o} = \frac{32 \cdot M_{b}}{\pi \cdot d_{small}}^{3}$$

Evaluate Formula

$$\sigma_{o} = \frac{32 \cdot M_{b}}{\pi \cdot d_{small}^{3}} = \frac{32 \cdot 23089.1 \, \text{N*mm}}{3.1416 \cdot 21.11004 \, \text{mm}^{3}}$$

2.5) Nominal Tensile Stress in Round Shaft with Shoulder Fillet Formula 🕝

Evaluate Formula (

$$\sigma_{0} = \frac{4 \cdot P}{\pi \cdot d_{small}}^{2} = \frac{4 \cdot 8750 \,\text{N}}{3.1416 \cdot 21.11004 \,\text{mm}}$$

2.6) Nominal Torsional Stress in Round Shaft with Shoulder Fillet Formula 🕝 Evaluate Formula C

Formula Example with Units
$$\sigma_{o} = \frac{16 \cdot M_{t}}{\pi \cdot d_{small}}$$

$$20 \, \text{N/mm}^{2} = \frac{16 \cdot 36942.57 \, \text{N*mm}}{3.1416 \cdot 21.11004 \, \text{mm}}$$



Formula Example with Units
$$C = 1 - 0.2 \cdot \frac{b_k}{d} - 1.1 \cdot \frac{h}{d}$$

$$0.88 = 1 - 0.2 \cdot \frac{5 \text{ mm}}{45 \text{ mm}} - 1.1 \cdot \frac{4 \text{ mm}}{45 \text{ mm}}$$

2.8) Smaller Diameter of Round Shaft with Shoulder Fillet in Tension or Compression Formula

Evaluate Formula (

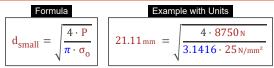
Evaluate Formula (

Evaluate Formula (

Evaluate Formula (

Evaluate Formula C

Evaluate Formula C



2.9) Tensile Force in Round Shaft with Shoulder Fillet given Nominal Stress Formula



2.10) Torsional Moment in Round Shaft with Shoulder Fillet given Nominal Stress Formula

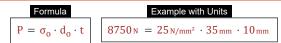


2.11) Width of Shaft Keyway given Ratio of Torsional Strength of Shaft with Keyway to without Keyway Formula 🕝

Formula Example with Units
$$b_k = 5 \cdot d \cdot \left(1 - C - 1.1 \cdot \frac{h}{d}\right) \boxed{5_{mm} = 5 \cdot 45_{mm} \cdot \left(1 - 0.88 - 1.1 \cdot \frac{4_{mm}}{45_{mm}}\right)}$$

3) Flat Plate against Fluctuating Loads Formulas

3.1) Load on Flat Plate with Shoulder Fillet given Nominal Stress Formula 🕝



3.2) Major Axis of Elliptical Crack Hole in Flat Plate given Theoretical Stress Concentration Factor Formula



3.3) Mean Stress for Fluctuating Load Formula 🕝

$$\sigma_{m} = \frac{\sigma_{max} + \sigma_{min}}{2}$$

Example with Units
$$180 \, \text{N/mm}^2 \, + \, 40 \, \text{N/$$

Evaluate Formula (

 $\sigma_m = \frac{\sigma_{max} + \sigma_{min}}{2} \left| \quad \right| \ 110 \, \text{N/mm}^2 \ = \ \frac{180 \, \text{N/mm}^2 \ + \ 40 \, \text{N/mm}^2}{2}$

3.4) Minor Axis of Elliptical Crack Hole in Flat Plate given Theoretical Stress Concentration Factor Formula 🕝



 $b_e = \frac{a_e}{k_t - 1}$ $15 \, \text{mm} = \frac{30 \, \text{mm}}{3 - 1}$

Evaluate Formula (

Evaluate Formula (

3.5) Nominal Tensile Stress in Flat Plate with Shoulder Fillet Formula

Formula
$$\sigma_0 = \frac{P}{d_0}$$

 $\sigma_0 = \frac{P}{d_0 \cdot t}$ $25 \text{ N/mm}^2 = \frac{8750 \text{ N}}{35 \text{ mm} \cdot 10 \text{ mm}}$

3.6) Smaller Width of Flat Plate with Shoulder Fillet given Nominal stress Formula 🕝



 $d_{o} = \frac{P}{\sigma_{o} \cdot t} \left| \quad 35 \, \text{mm} \right| = \frac{8750 \, \text{N}}{25 \, \text{N/mm}^{2} \cdot 10 \, \text{mm}}$

Evaluate Formula [

3.7) Theoretical Stress Concentration Factor Formula 🕝

Formula
$$k_t = \frac{\sigma a_{max}}{\sigma_o}$$

Example with Units Evaluate Formula [

3.8) Theoretical Stress Concentration Factor for Elliptical Crack Formula C



 $k_t = 1 + \frac{a_e}{b_e}$ $3 = 1 + \frac{30 \, \text{mm}}{15 \, \text{mm}}$

Evaluate Formula

3.9) Thickness of Flat Plate with Shoulder Fillet given Nominal Stress Formula 🕝

 $t = \frac{P}{\sigma_0 \cdot d_0}$ $10_{mm} = \frac{8750 \,\text{N}}{25 \,\text{N/mm}^2 \cdot 35_{mm}}$

Evaluate Formula C

Variables used in list of Stress Concentration Factors in Design Formulas above

- ae Major Axis of Elliptical Crack (Millimeter)
- b_e Minor Axis of Elliptical Crack (Millimeter)
- b_k Width of Key in Round Shaft (Millimeter)
- · C Ratio of Shaft Strength
- d Diameter of Shaft with Keyway (Millimeter)
- d_n Diameter of Transverse Hole in Plate (Millimeter)
- do Smaller Width of Plate (Millimeter)
- d_{small} Smaller Diameter of Shaft with Fillet (Millimeter)
- **h** Height of Shaft Keyway (Millimeter)
- k_f Fatigue Stress Concentration Factor
- k_t Theoretical Stress Concentration Factor
- M_b Bending Moment on Round Shaft (Newton Millimeter)
- M_t Torsional Moment on Round Shaft (Newton Millimeter)
- P Load on Flat Plate (Newton)
- t Thickness of Plate (Millimeter)
- w Width of Plate (Millimeter)
- σ_m Mean Stress for Fluctuating Load (Newton per Square Millimeter)
- σ_{max} Maximum Stress at Crack Tip (Newton per Square Millimeter)
- σ_{min} Minimum Stress at Crack Tip (Newton per Square Millimeter)
- σ_o Nominal Stress (Newton per Square Millimeter)
- σa_{max} Highest Value of Actual Stress near Discontinuity (Newton per Square Millimeter)
- T_o Nominal Torsional Stress for Fluctuating Load (Newton per Square Millimeter)

Constants, Functions, Measurements used in list of Stress Concentration Factors in Design Formulas above

- constant(s): pi,
 3.14159265358979323846264338327950288
 Archimedes' constant
- 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 Millimeter (mm)
 Length Unit Conversion
- Measurement: Force in Newton (N)
 Force Unit Conversion
- Measurement: Torque in Newton Millimeter (N*mm)
 Torque Unit Conversion
- Measurement: Stress in Newton per Square Millimeter (N/mm²)
 Stress Unit Conversion

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• 🛂 Simple fraction 🕝

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