



# Bolt Loads in Gasket Joints Formulas

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### **List of 16 Bolt Loads in Gasket Joints Formulas**

## Bolt Loads in Gasket Joints &

1) Actual Cross-sectional Area of Bolts given Root Diameter of Thread

 $A_b = \frac{2 \cdot \pi \cdot y_{sl} \cdot G \cdot N}{\sigma_{gs}}$ 

Open Calculator

 $extbf{ex} 126.6466 ext{mm}^2 = rac{2 \cdot \pi \cdot 3.85 ext{N/mm}^2 \cdot 32 ext{mm} \cdot 4.1 ext{mm}}{25.06 ext{N/mm}^2}$ 

2) Bolt Load in Design of Flange for Gasket Seating

 $W_{m1} = \left(rac{A_m + A_b}{2}
ight) \cdot \sigma_{gs}$ 

Open Calculator 🗗

 $extbf{ex} 15612.38 ext{N} = \left(rac{1120 ext{mm}^2 + 126 ext{mm}^2}{2}
ight) \cdot 25.06 ext{N/mm}^2$ 

3) Bolt load under operating condition

 $\left[ \mathbf{W}_{\mathrm{m}1} = \mathrm{H} + \mathrm{H}_{\mathrm{p}} 
ight]$ 

Open Calculator

 $| 15486 \mathrm{N} = 3136 \mathrm{N} + 12350 \mathrm{N} |$ 

4) Bolt Load under operating condition given Hydrostatic End Force

 $\mathbf{W}_{\mathrm{m}1} = \left( \left( rac{\pi}{4} 
ight) \cdot \left( \mathrm{G} 
ight)^2 \cdot \mathrm{P} 
ight) + \left( 2 \cdot \mathrm{b_g} \cdot \pi \cdot \mathrm{G} \cdot \mathrm{P} \cdot \mathrm{m} 
ight)$ 

Open Calculator 🗗

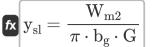
ex

 $\left(15516.2 \mathrm{N} = \left(\left(rac{\pi}{4}
ight) \cdot \left(32 \mathrm{mm}
ight)^2 \cdot 3.9 \mathrm{MPa}
ight) + \left(2 \cdot 4.21 \mathrm{mm} \cdot \pi \cdot 32 \mathrm{mm} \cdot 3.9 \mathrm{MPa} \cdot 3.75
ight)^2 + \left(2 \cdot 4.21 \mathrm{mm} \cdot \pi \cdot 32 \mathrm{mm} \cdot 3.9 \mathrm{MPa} \cdot 3.75
ight)^2 + \left(2 \cdot 4.21 \mathrm{mm} \cdot \pi \cdot 32 \mathrm{mm} \cdot 3.9 \mathrm{MPa} \cdot 3.75
ight)^2$ 





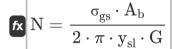
# 5) Deflection of Spring Initial Bolt Load to Seal Gasket Joint



Open Calculator

$$=$$
  $3.792216 \mathrm{N/mm^2} = rac{1605 \mathrm{N}}{\pi \cdot 4.21 \mathrm{mm} \cdot 32 \mathrm{mm}}$ 

### 6) Gasket Width given actual Cross-sectional Area of Bolts



Open Calculator

$$=$$
  $rac{25.06 ext{N/mm}^2 \cdot 126 ext{mm}^2}{2 \cdot \pi \cdot 3.85 ext{N/mm}^2 \cdot 32 ext{mm}}$ 

### 7) Hydrostatic Contact Force given Bolt Load under Operating condition

 $\mathbf{K} \left[ \mathrm{H_p} = \mathrm{W_{m1}} - \left( \left( rac{\pi}{4} 
ight) \cdot (\mathrm{G})^2 \cdot \mathrm{P} 
ight) 
ight]$ 

Open Calculator 🗗

ex 
$$12349.43$$
N =  $15486$ N  $-\left(\left(\frac{\pi}{4}\right) \cdot (32$ mm $)^2 \cdot 3.9$ MPa $)$ 

## 8) Hydrostatic end force

 $H = W_{m1} - H_p$ 

Open Calculator

$$\texttt{ex} \ 3136 \texttt{N} = 15486 \texttt{N} - 12350 \texttt{N}$$

### 9) Hydrostatic End Force given Bolt Load under Operating condition

$$\mathbf{K} = \mathbf{W}_{\mathrm{m}1} - (2 \cdot \mathbf{b}_{\mathrm{g}} \cdot \pi \cdot \mathbf{G} \cdot \mathbf{m} \cdot \mathbf{P})$$

Open Calculator 🗗

ex 
$$3106.366 \text{N} = 15486 \text{N} - (2 \cdot 4.21 \text{mm} \cdot \pi \cdot 32 \text{mm} \cdot 3.75 \cdot 3.9 \text{MPa})$$



# 10) Initial Bolt Load to seat Gasket Joint

fx  $W_{
m m2} = \pi \cdot {
m b_g} \cdot {
m G} \cdot {
m y_{sl}}$ 

Open Calculator 🚰

ex  $1629.456 \mathrm{N} = \pi \cdot 4.21 \mathrm{mm} \cdot 32 \mathrm{mm} \cdot 3.85 \mathrm{N/mm^2}$ 

# 11) Load on bolts based on hydrostatic end force

 $\mathbf{F}_{\mathrm{b}} = \mathbf{f}_{\mathrm{s}} \cdot \mathbf{P}_{\mathrm{t}} \cdot \mathbf{A}_{\mathrm{m}}$ 

Open Calculator

 $\texttt{ex} \boxed{18816 \text{N} = 3 \cdot 5.6 \text{MPa} \cdot 1120 \text{mm}^2}$ 

# 12) Stress Required for Gasket Seating

 $\sigma_{
m gs} = rac{2 \cdot \pi \cdot {
m y_{sl}} \cdot {
m G} \cdot {
m N}}{{
m A_{b}}}$ 

Open Calculator

 $ext{ex} \ 25.18859 ext{N/mm}^2 = rac{2 \cdot \pi \cdot 3.85 ext{N/mm}^2 \cdot 32 ext{mm} \cdot 4.1 ext{mm}}{126 ext{mm}^2}$ 

# 13) Stress Required for Gasket Seating given Bolt Load

 $\sigma_{gs} = rac{W_{m1}}{rac{A_m + A_b}{2}}$   $\sigma_{gs} = rac{W_{m1}}{rac{A_m + A_b}{2}}$   $\sigma_{gs} = rac{W_{m1}}{rac{A_m + A_b}{2}}$   $\sigma_{gs} = rac{W_{m1}}{rac{A_m + A_b}{2}}$ 

Open Calculator 🚰

2

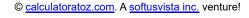
### 14) Test pressure given Bolt Load 🚰

$$P_{
m t} = rac{F_{
m b}}{f_{
m s} \cdot A_{
m m}}$$

Open Calculator

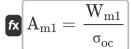
 $= \frac{18150 \mathrm{N}}{3 \cdot 1120 \mathrm{mm}^2}$ 







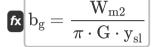
### 15) Total cross-sectional area of bolt at root of thread



Open Calculator

$$\boxed{ 297.8077 \text{mm}^{_2} = \frac{15486 \text{N}}{52 \text{N}/\text{mm}^{_2}} }$$

## 16) Width of U Collar given Initial Bolt Load to Seat Gasket Joint



Open Calculator

$$=$$
  $rac{1605 ext{N}}{\pi \cdot 32 ext{mm} \cdot 3.85 ext{N/mm}^2}$ 



#### Variables Used

- A<sub>b</sub> Actual Bolt Area (Square Millimeter)
- A<sub>m</sub> Greater Cross-section Area of Bolts (Square Millimeter)
- A<sub>m1</sub> Bolt Cross-Sectional Area at Root of Thread (Square Millimeter)
- b<sub>q</sub> Width of u-collar in Gasket (Millimeter)
- **F**<sub>b</sub> Bolt Load in Gasket Joint (Newton)
- fs Factor of Safety for Bolt Packing
- **G** Gasket Diameter (Millimeter)
- **H** Hydrostatic End Force in Gasket Seal (Newton)
- H<sub>p</sub> Total Joint Surface Compression Load (Newton)
- m Gasket Factor
- N Gasket Width (Millimeter)
- P Pressure at Outer Diameter of Gasket (Megapascal)
- Pt Test Pressure in Bolted Gasket Joint (Megapascal)
- W<sub>m1</sub> Bolt Load Under Operating Condition for Gasket (Newton)
- W<sub>m2</sub> Initial Bolt Load to Seat the Gasket Joint (Newton)
- y<sub>sl</sub> Gasket Unit Seating Load (Newton per Square Millimeter)
- $\sigma_{qs}$  Stress Required for Gasket Seating (Newton per Square Millimeter)
- $\sigma_{oc}$  Stress Required for Operating Condition for Gasket (Newton per Square Millimeter)





### Constants, Functions, Measurements used

- Constant: pi, 3.14159265358979323846264338327950288
   Archimedes' constant
- Measurement: Length in Millimeter (mm)
  Length Unit Conversion
- Measurement: Area in Square Millimeter (mm²)
   Area Unit Conversion
- Measurement: Pressure in Megapascal (MPa)
  Pressure Unit Conversion
- Measurement: Force in Newton (N)
   Force Unit Conversion
- Measurement: Stress in Newton per Square Millimeter (N/mm²)

  Stress Unit Conversion





#### **Check other formula lists**

- Bolt Loads in Gasket Joints
   Formulas
- Elastic Packing Formulas
- V Ring Packing Formulas

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