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Butt Welds Formulas

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List of 16 Butt Welds Formulas

Butt Welds

1) Average Tensile Stress in Butt Weld

$$fx \quad \sigma_t = \frac{P}{L \cdot h_t}$$

Open Calculator 

$$ex \quad 56.41026 \text{N/mm}^2 = \frac{16.5 \text{kN}}{19.5 \text{mm} \cdot 15 \text{mm}}$$

2) Efficiency of Butt Welded Joint

$$fx \quad \eta = \frac{P}{\sigma_t \cdot t_p \cdot L}$$

Open Calculator 

$$ex \quad 0.833485 = \frac{16.5 \text{kN}}{56.4 \text{N/mm}^2 \cdot 18 \text{mm} \cdot 19.5 \text{mm}}$$

3) Inner Diameter of Boiler given Thickness of Welded Boiler Shell

$$fx \quad D_i = t \cdot 2 \cdot \frac{\sigma_t \text{ boiler}}{P_i}$$

Open Calculator 

$$ex \quad 1400 \text{mm} = 30 \text{mm} \cdot 2 \cdot \frac{105 \text{N/mm}^2}{4.5 \text{MPa}}$$



4) Internal Pressure in Boiler given Thickness of Welded Boiler Shell

[Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$fx \quad P_i = t \cdot 2 \cdot \frac{\sigma_t \text{ boiler}}{D_i}$$

$$ex \quad 4.5\text{MPa} = 30\text{mm} \cdot 2 \cdot \frac{105\text{N/mm}^2}{1400\text{mm}}$$

5) Length of Butt Weld given Average Tensile Stress in Weld

[Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

$$fx \quad L = \frac{P}{\sigma_t \cdot h_t}$$

$$ex \quad 19.50355\text{mm} = \frac{16.5\text{kN}}{56.4\text{N/mm}^2 \cdot 15\text{mm}}$$

6) Length of Butt Weld given Efficiency of Welded Joint

[Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)

$$fx \quad L = \frac{P}{\sigma_t \cdot t_p \cdot \eta}$$

$$ex \quad 19.51135\text{mm} = \frac{16.5\text{kN}}{56.4\text{N/mm}^2 \cdot 18\text{mm} \cdot 0.833}$$

7) Permissible Tensile Stress in Butt Weld

[Open Calculator !\[\]\(2bae76de5ebbd5c4d7d47162f1673734_img.jpg\)](#)

$$fx \quad \sigma_t = \frac{P}{L \cdot t_p}$$

$$ex \quad 47.00855\text{N/mm}^2 = \frac{16.5\text{kN}}{19.5\text{mm} \cdot 18\text{mm}}$$



8) Permissible Tensile Stress in Butt Weld given Efficiency of Welded joint



$$fx \quad \sigma_t = \frac{P}{t_p \cdot L \cdot \eta}$$

[Open Calculator](#)

$$ex \quad 56.43283\text{N/mm}^2 = \frac{16.5\text{kN}}{18\text{mm} \cdot 19.5\text{mm} \cdot 0.833}$$

9) Strength of Butt Welded Joint



$$fx \quad \sigma_{tb} = \frac{P}{b_{ns} \cdot L_b}$$

[Open Calculator](#)

$$ex \quad 56.41026\text{N/mm}^2 = \frac{16.5\text{kN}}{15\text{mm} \cdot 19.5\text{mm}}$$

10) Tensile Force on Butt Welded Plates given Thickness of Plate



$$fx \quad P = \sigma_t \cdot L \cdot h_t$$

[Open Calculator](#)

$$ex \quad 16.497\text{kN} = 56.4\text{N/mm}^2 \cdot 19.5\text{mm} \cdot 15\text{mm}$$

11) Tensile Force on Plates given Average Tensile Stress in Butt Weld



$$fx \quad P = \sigma_t \cdot h_t \cdot L$$

[Open Calculator](#)

$$ex \quad 16.497\text{kN} = 56.4\text{N/mm}^2 \cdot 15\text{mm} \cdot 19.5\text{mm}$$



12) Tensile Force on Plates given Efficiency of Butt Welded Joint

$$fx \quad P = \sigma_t \cdot t_p \cdot L \cdot \eta$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$ex \quad 16.4904kN = 56.4N/mm^2 \cdot 18mm \cdot 19.5mm \cdot 0.833$$

13) Tensile Stress in Boiler Butt Weld given Thickness of Boiler Shell

$$fx \quad \sigma_{t \text{ boiler}} = P_i \cdot \frac{D_i}{2 \cdot t}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$ex \quad 105N/mm^2 = 4.5MPa \cdot \frac{1400mm}{2 \cdot 30mm}$$

14) Thickness of Plate given Efficiency of Butt Welded Joint

$$fx \quad t_p = \frac{P}{\sigma_t \cdot L \cdot \eta}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$ex \quad 18.01048mm = \frac{16.5kN}{56.4N/mm^2 \cdot 19.5mm \cdot 0.833}$$


15) Thickness of Welded Boiler Shell given Stress in Weld

$$fx \quad t = P_i \cdot \frac{D_i}{2 \cdot \sigma_{t \text{ boiler}}}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$ex \quad 30mm = 4.5MPa \cdot \frac{1400mm}{2 \cdot 105N/mm^2}$$



16) Throat of Butt Weld given Average Tensile Stress [Open Calculator](#) 

$$\text{fx } h_t = \frac{P}{L \cdot \sigma_t}$$

$$\text{ex } 15.00273\text{mm} = \frac{16.5\text{kN}}{19.5\text{mm} \cdot 56.4\text{N/mm}^2}$$







Variables Used

- b_{ns} Beam Width for Nominal Shear (Millimeter)
- D_i Inner diameter of boiler (Millimeter)
- h_t Throat Thickness of Weld (Millimeter)
- L Length of Weld (Millimeter)
- L_b Length of Butt Weld (Millimeter)
- P Tensile Force on Welded Plates (Kilonewton)
- P_i Internal pressure in boiler (Megapascal)
- t Thickness of Boiler Wall (Millimeter)
- t_p Welded Base Plate Thickness (Millimeter)
- η Efficiency of Welded Joints
- $\sigma_{t \text{ boiler}}$ Tensile Stress in Boiler Butt Weld (Newton per Square Millimeter)
- σ_t Tensile Stress in Weld (Newton per Square Millimeter)
- σ_{tb} Tensile Stress in Butt Weld (Newton per Square Millimeter)



Constants, Functions, Measurements used

- **Measurement: Length** in Millimeter (mm)
Length Unit Conversion 
- **Measurement: Pressure** in Megapascal (MPa)
Pressure Unit Conversion 
- **Measurement: Force** in Kilonewton (kN)
Force Unit Conversion 
- **Measurement: Stress** in Newton per Square Millimeter (N/mm²)
Stress Unit Conversion 



Check other formula lists

- [Butt Welds Formulas](#) 
- [Parallel Fillet Welds Formulas](#) 
- [Transverse Fillet Weld Formulas](#) 

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