Fillet and Butt Weld Strength

Allowable load of a fillet weld (throat 0.707 s) in shear or a butt weld in tension from size, length and allowable stress, with the weld length needed.

Method: Throat-area method (Shigley's Mechanical Engineering Design (Budynas and Nisbett), ch. 9; AWS and IS 816 use the same throat definition)

Input parameters

Unit system: SI

Parameter	Value	Unit
Weld type	Fillet weld, shear on the throat	
Fillet leg size, or plate thickness for a butt weld	8.0000	mm
Effective weld length	200.00	mm
Allowable stress on the throat or section From your design code or specification for the weld metal and loading.	94.000	MPa
Applied load (to find the length needed)	100.00	kN

Calculated results

Parameter	Value	Unit
Throat thickness	5.6569	mm
Throat area	1,131.4	mm²
Allowable load	106.35	kN
Stress under the applied load	88.388	MPa
Weld length needed for the applied load	188.06	mm

Notes for this case

- Throat of an equal-leg fillet is s cos 45° = 0.707 s. Allowable stresses and length deductions for weld ends follow your design code.

Formula and method

$$t = 0.707\,s \ \text{(fillet)}, \quad F_a = t\,L\,\tau_a, \quad L_{req} = \frac{F}{t\,\tau_a}$$

Variables

weld	Weld type	-
s	Fillet leg size, or plate thickness for a butt weld	m
L	Effective weld length	m
τ_a	Allowable stress on the throat or section	Pa
F	Applied load (to find the length needed)	N
t	Throat thickness	m
A	Throat area	m²
F_a	Allowable load	N
τ	Stress under the applied load	Pa
L_{req}	Weld length needed for the applied load	m

Method and standards

Throat area method.

Assumptions and limits

- Straight weld under a direct load through the weld group's centroid. Eccentric loads (bending or torsion on the weld group) are not covered, and no length is deducted for start and end craters or returns; apply your code's allowable stress and deductions.
- Static load, equal-leg fillet.

References

• Throat-area method (Shigley's Mechanical Engineering Design (Budynas and Nisbett), ch. 9; AWS and IS 816 use the same throat definition)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/mechanical/machine-design/weld-joint-strength

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.