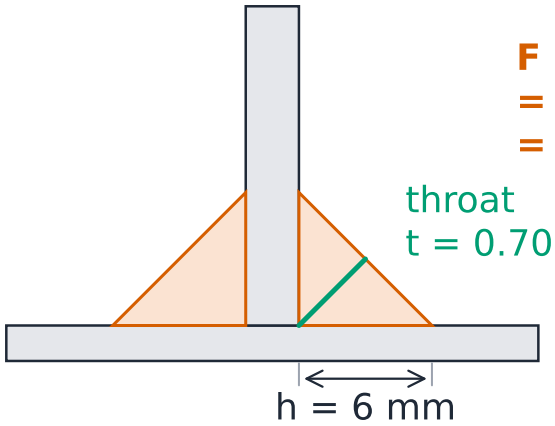
Exercise walk-through

8.4 Joining

University Mechanical Engineering

Joining: the throat carries the load

fillet weld: size h, throat 0.707h carries the load



F = 0.707 h L τ_allow
= 0.707 × 6 × 200 × 145
= 123 kN

Two 100 mm fillets, $h = 6$ mm, $\tau_{allow} = 0.3 \times 482 = 145$ MPa: $F = 0.707hL\tau =$ **123** kN. **Heat input** $\eta VI/v =$ **800** J/mm.

The bonded cover

1. **Lap joint** 25×12.5 mm overlap, epoxy at 20 MPa average shear: $\mathbf{6.25}$ kN.
2. **Ends** The shear peaks at the overlap ends, so doubling the overlap does not double the strength.
3. **Design** Load the bond in shear, never in peel; prepare and clean the surfaces.

Exercises 2.1·2.2

2.1 Find the throat of an 8 mm fillet weld (two decimals, mm). [2]

2.2 Two 8 mm fillets, each 80 mm long, hold a bracket in shear. Find the allowable load (one decimal, kN). [3]

Exercises 2.1·2.2

2.1 Find the throat of an 8 mm fillet weld (two decimals, mm). [2]

2.1

- $t = 0.707h = 0.707 \times 8 = \mathbf{5.66}$ mm.

2.2 Two 8 mm fillets, each 80 mm long, hold a bracket in shear. Find the allowable load (one decimal, kN). [3]

2.2

- $F = 0.707hL\tau_{allow} = 0.707 \times 8 \times 160 \times 145 = \mathbf{131.2}$ kN.

Exercise 2.3

2.3 The welder runs at 28 V and 220 A, travelling 4 mm/s, with $\eta = 0.8$. Find the heat input (nearest J/mm). Is it higher or lower than the 800 J/mm of the worked example, and what does more heat do to the zone beside the weld? [3]

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2.3

- $H = \eta V I / v = 0.8 \times 28 \times 220/4 =$ **1232** J/mm.
- Higher: a wider, slower-cooling heat-affected zone, with more grain growth and distortion.

Exercise 3.1

3.1 A 90 kN shear load is to be carried by two equal 6 mm fillet welds. Find the total and the per-weld length (round up to 5 mm). As an alternative, a single-lap epoxy bond 30×20 mm with average shear strength 20 MPa is proposed for a 12 kN cover. Find its average strength and explain why doubling the overlap would not double it. [6]

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3.1

- $L = F/(0.707 h \tau_{allow}) = 90\,000/(0.707 \times 6 \times 145) = 146.3$ mm in total.
- Per weld $146.3/2 = 73.2$, so **75** mm each.
- Bond: $F = \tau A = 20 \times 30 \times 20 = \mathbf{12.0}$ kN on average, just enough.
- The load transfers near the overlap ends, where the stress peaks; the middle carries little, so a longer overlap adds less than its area.