Chapter - 9
Design of Welded & Threaded Joints

Q.1 A plate 100mm wide and 10mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa.

Solution- Given width = 100mm, Thickness = 10mm, P = 80kN = 80000 N, $\tau = 55 MPa = 55 N/mm^2$

Let l = Length of weld

s = Size of weld = Plate thickness = 10mm

Max^m load which the plates can carry for double parallel fillet weld (P)

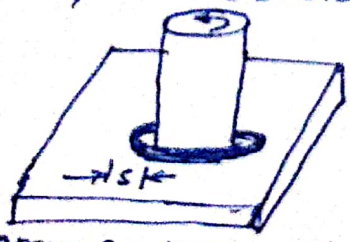
$$P = 1.414 \times s \times l \times \tau = 1.414 \times 10 \times l \times 55 = 778l$$

$$l = \frac{P}{778} = \frac{80 \times 10^3}{778} = 103 mm$$

Adding 15 mm for starting & stopping of weld run

$$l = 103 + 15 = 118 mm$$

Q.2 A 50mm diameter solid shaft is welded to a flat plate by 10mm fillet weld as shown in fig. Find the maximum torque that the welded joint can sustain if the maximum shear stress intensity in the weld material is not to exceed 80 MPa.



Solution- $d = 50mm, s = 10mm, \tau_{max} = 80 MPa = 80 N/mm^2$

T = Maximum torque that the welded joint can sustain.

$$\tau_{max} = \frac{2.83T}{\pi s d^2}$$

$$80 = \frac{2.83T}{\pi \times 10 \times (50)^2}$$

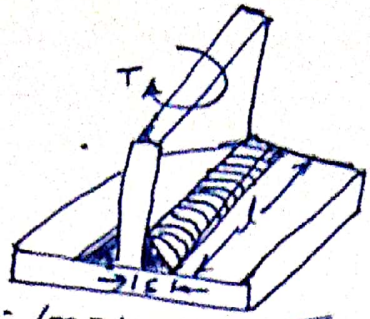
$$T = 80 \times \frac{78550}{2.83}$$

$$= 2.22 \times 10^6 Nmm$$

$$\boxed{T = 2.22 kNm}$$

Q.3 - A plate 1m long, 60mm thick is welded to another plate at right angle to each other by 15mm fillet weld, as

shown in fig. Find the max^m torque that the welded joint can sustain if the permissible shear stress intensity in the weld material is not to be exceed 80mPa.



Solution- Given l = 1m = 1000mm, Thickness = 60mm, S = 15mm.

τ_{max} = 80mPa = 80 N/mm^2

Let. T = Maximum torque that the welded joint can sustain.

$$80 = \frac{4.242T}{S \times l^2} = \frac{4.242 \times T}{15(1000)^2} = \frac{0.283T}{10^6}$$

$$T = 80 \times 10^6 / 0.283 = 283 \times 10^6 \text{ Nmm} = 283 \text{ kNm}$$

Question 4 A plate 100mm wide and 12.5mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50kN. Find the length of the weld so that the maximum stress does not exceed 56mPa. Consider the joint first under static loading and then under fatigue loading.

Solution.- Given Width = 100mm, Thickness = 12.5mm

P = 50kN = 50 x 10^3 N, τ = 56 mPa = 56 N/mm^2

Length of weld for static loading -

l = Length of weld

S = Size of weld = plate thickness = 12.5mm

Maximum load which the plates can carry for double parallel fillet welds (P)

$$P = 1.414 \times S \times l \times \tau$$

$$= 1.414 \times 12.5 \times l \times 56$$

$$P = 990l$$

$$l = \frac{P}{990} = \frac{50 \times 10^2}{990} = 50.5\text{mm}$$

Adding 15mm for starting and stopping of weld run we have

$$l = 50.5 + 15 = 65.5\text{mm}$$

Length of weld for fatigue Loading -

Permissible shear stress considering concentration factor for parallel fillet welding is 2.7

$$\tau = \frac{56}{2.7} = 20.74 \text{ N/mm}^2$$

We know that the maximum load which the plates can carry for double parallel fillet welds (P)

$$P = 1.414 \times S \times l \times \tau$$

$$P = 1.414 \times 12.5 \times l \times 20.74$$

$$l = \frac{P}{367} = \frac{50 \times 10^3}{367} = 136.2\text{mm}$$

Adding 15mm for starting and stopping of weld run

$$l = 136.2 + 15 = 151.2$$

$$\boxed{l = 151.2\text{mm}}$$

Question: A plate 75mm wide and 12.5mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in figure. The maximum tensile and shear stresses are 70MPa and 56MPa respectively. Find the length of each parallel fillet weld if the joint is subjected to both static and fatigue loading.

Answer: 5 Given - Width = 75mm
Thickness = 12.5mm

$\sigma_t = 70MPa = 70N/mm^2$

$\tau = 56MPa = 56N/mm^2$

The effective length of weld (l_1) for the transverse weld may be obtained by substracting 12.5mm from the width of plate

$l_1 = 75 - 12.5 = 62.5mm$

Length of each parallel fillet for static loading

$P_1 = 0.707 \times s \times l_1 \times \sigma_t$

$= 0.707 \times 12.5 \times 62.5 \times 70$

$P_1 = 38664N$

The load carried by double parallel fillet weld

$P_2 = 1.414 \times 12.5 \times l_2 \times 56$

$P_2 = 990 l_2 N$

$P = P_1 + P_2$

$65625 = 38664 + 990 l_2$

$\boxed{l_2 = 27.2mm}$

Adding 15mm for starting and stopping effect

$l_2 = 27.2 + 15$

$\boxed{l_2 = 42.2mm}$

Length of each parallel fillet for fatigue loading

Permissible tensile stress

$\sigma_t = \frac{70}{1.5} = 46.7N/mm^2$

Permissible shear stress

$\tau = \frac{56}{2.7} = 20.74N/mm^2$

Load carried by single transverse weld

$P_1 = 0.707 \times s \times l_1 \times \sigma_t$

$= 0.707 \times 12.5 \times 62.5 \times 46.7$

$\boxed{P_1 = 25795N}$

Load carried by double parallel fillet weld

$P_2 = 1.414 \times s \times l_2 \times \tau$

$= 1.414 \times 12.5 \times l_2 \times 20.74$

$P_2 = 366 l_2 N$

$\therefore 65625 = P_1 + P_2 = 25795 + 366 l_2$

$\boxed{l_2 = 108.8 mm}$

Adding 15mm for starting and stopping of weld run

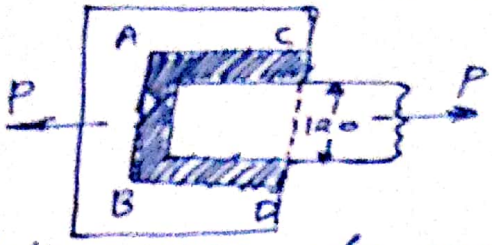
$l_2 = 108.8 + 15 = 123.8 mm$

Question-6 Determine the Length of the weld run for a plate of size 80mm wide and 15mm thick to be welded to another plate by means of

1. A single transverse weld.
2. Double parallel fillet welds when the joint is subjected to various loads.

Solution - Given Width = 120mm

Thickness = 15mm



AB = Single transverse weld
AC & BD = Double parallel fillet weld

① Length of the weld run for a single transverse weld

$l_1 = 120 - 15 = 105 mm$

② Length of the weld run for a double parallel fillet weld subjected to variable loads

Load carried by single transverse weld

$P_1 = 0.707 \times s \times l_1 \times \sigma_t$

$= 0.707 \times 15 \times 105 \times 46.7$

$= 52001.617 N$

Double parallel fillet weld

$P_2 = 1.414 s l_2 \tau$

$= 1.414 \times 15 \times l_2 \times 20.74$

$P_2 = 440 l_2 N$

$P = P_1 + P_2$

$126 \times 10^3 = P_1 + P_2 = 53240 + 440 l_2$

$\boxed{l_2 = 165.4 mm}$

Adding 15mm for starting and stopping of weld run

$l_2 = 165.4 + 15$

$\boxed{l_2 = 170.4 mm}$