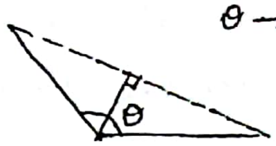
θ → angle between fusion faces



θ	60°–90°	91°–100°	101°–106°	107°–113° (−6°)	114°–120° (−6°)
K	0.7	0.65	0.6	0.55	0.5

→ Throat thickness is the minimum thickness on which shearing will occur

→ K is a constant, that depends on the angle between the fusion faces.

Note :-

→ if θ < 60° or θ > 120°, fillet weld is not recommended

• Effective length ;

→ (UPSC) (2 or 3)

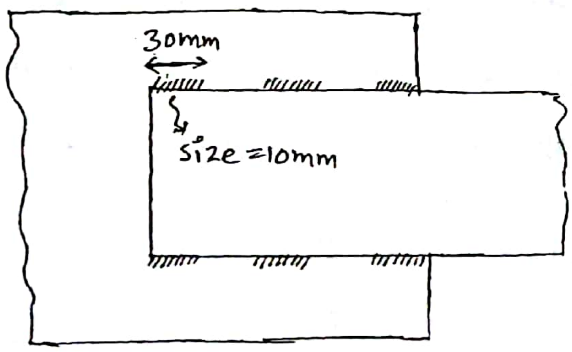
$$\text{Effective length} = \text{Overall length} - 2s$$
$$\not< 4s$$

where; s → size of weld

In the structural drawing only effective length is shown.

Minimum length required for a weld to be 100% effective is 4s, if minimum length is less than 4s, then effective size is taken as $\frac{1}{4}$th of the effective length.

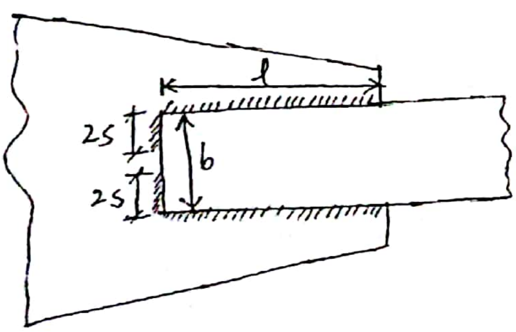
Ex:-



→ $s_{provided} = 10mm$

minimum 'l' = 4×s = 40mm

Actual $s = \frac{30}{4} = 7.5mm$



→ minimum end return = 2s

→ $l \not< b$

→ $b \not> 16t$

→ End returns are provided to release the weld from high stress concentration at their ends. It must always be provided if the joints are subjected to stress reversals, impact and eccentricity

→ $l \nless b$ → length of side fillet should not be less than width of plate

→ $b \ngtr 16t$ → Because as 'b' increases, non-uniformity of stress in the plate increases, if plate is wider than 16t slot or Plug welds must be introduced.

where, t → thickness of thinner plate

→ If the length of welded joint is greater than $150t_t$, the strength of the weld will be reduced by a factor;

$$\beta_{lj} = 1.2 - \frac{0.2 l_j}{150 t_t} \leq 1.0$$

where; l_j → length of the welded joint in the direction of load transfer

t_t → effective throat thickness.

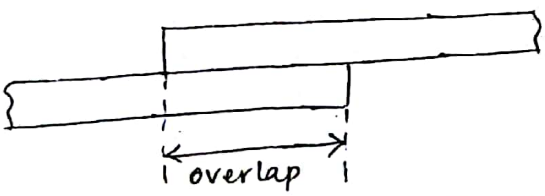
4. Effective Area (A_e);

$$A_e = l_w \times t_t$$

where; l_w → effective length of weld

t_t → effective throat thickness

5. Overlap;



$$\text{Overlap} \nless (4t \text{ or } 40\text{mm})_{max}$$

where; t → thickness of thinner part being jointed.

6. Design strength;

→ The design strength of fillet weld is based on its effective area.

Scanned by CamScanner

$$P_{dw} = \frac{f_u l_w t_t}{\sqrt{3}\,\gamma_{mw}} = \frac{f_u l_w KS}{\sqrt{3}\,\gamma_{mw}}$$

$f_u \rightarrow$ ultimate strength of Plate (or) weld (whichever is minimum)

where; $l_w \rightarrow$ effective length of weld

$t_t \rightarrow$ effective throat thickness $= KS$

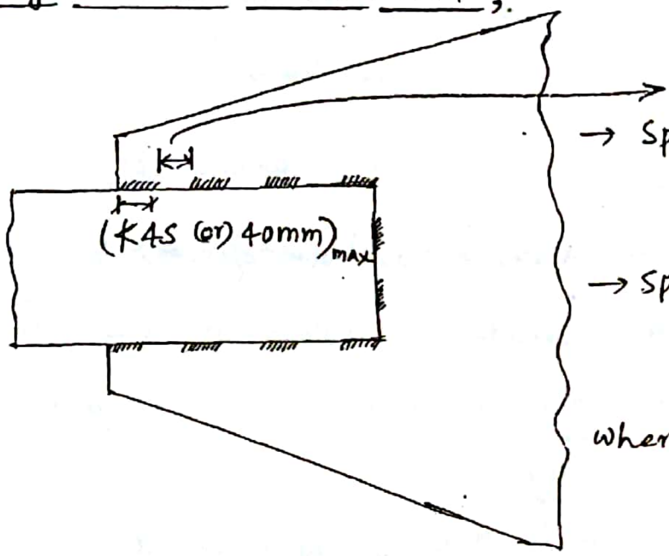
$S \rightarrow$ size of weld

$f_u \rightarrow$ Smaller of the ultimate strength of weld (or) Parent metal

$\gamma_{mw} = 1.25$ for shop welding

$= 1.5$ for field welding

⇒ Design of Intermittent fillet weld;

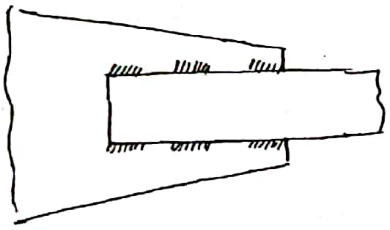


→ Spacing ≯ (16t or 200mm)min for tension member

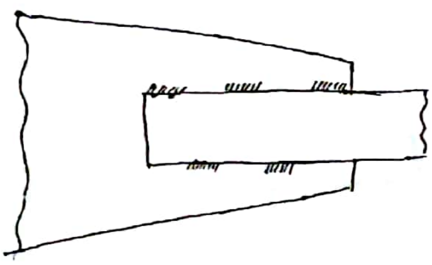
→ Spacing ≯ (12t or 200mm)min for Compression member

where; $t \rightarrow$ thickness of thinner part being jointed.

• When the length of smallest size fillet weld required to transmit load is less than the Continuous length of joint, intermittent fillet weld will be provided. But intermittent fillet weld cannot be used for dynamic & repetitive loads.



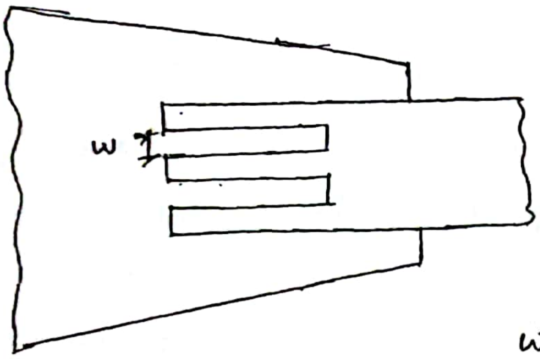
* Chain pattern



* Staggered pattern.

→ we will follow the chain pattern due to symmetry.

→ Plug & slot weld;



→ W (or) D ≮ (3t (or) 25mm)$_{max}$

where, t → thickness of the plate in which slot is made.

→ Working stress design;

→ The provision of limit state design also apply to the design of welds by working stress design, except for allowable stress calculation as follows;

i) Actual stress in the throat of fillet weld should be less than (or) equal to permissible shear stress of the weld i.e. $f_{aw} = 0.4 f_y$

ii) Actual stress in the butt weld should be less than the permissible stress as governed by the parent metal welded