ever is lesser]

where = t is the thickness of the thinner member.

Q. Find out the maximum pitch in case of tension member if two members 200x12 mm and 200x16 mm are connected.

Max. picth = 16x12 = 192 & 200 m

Q. Find out the maximum pitch in case of compare members if two plate 400x200 और 400x24.

Max. pitch = 12x20 = 240 mm> 200 mm

200 mm

❖ **Tacking Rivet:-**

⇒ ऐसी Rivets जिनके द्वारा कोई load carry नही किया जाता हो अर्थात् Non load bearing Rivet जिनका उपयोग केवल दो members को आपस मे केवल connect करने के लिए किया जाता है और taching Rivet उस condition में उपयोग लायी जाती है जब compression member के case में pitch 12t और 200 mm से अधिक बढ जाये तथा tension member के case में 16t और 200 mm से अधिक बढ जाती है। उसे tacking Rivet कहलाती है।

❖ Maximum pitch of tacking Rivet in case of compression member should not acced:- 600 mm से अधिक नही होनी चाहिए।

⇒ Max. pitch of taking Rivet in case of tension member should not exceed = 1000 mm

Note:-

(1) Max. pitch in case of bult up member for tacking Rivet in member are not exposed to weather = 32 t or 300 mm

which ever is lesser

(2) Max. pitch for built up member in case of tacking Rivet should not exceed if member are exposed to weather = 16 t or 200 mm

❖ **Minimum pitch in case of Rivet**:- Minimum pitch in case of Rivet, not less than 2.5 times of the nominal diameter of Rivet.

Welded joint

❖ **Welded joint**:- यदि दो members को आपस में welding करके जोडा जा रहा हो तो इस प्रकार से बना joint welded joint कहलाता है।

⇒ weled joint को निम्न प्रकार से classified किया जाता है।

(1) Fillet weld
(2) Butt weld
(3) Slot weld
(4) Flug weld

(1) **<u>Fillet weld:-</u>**

⇒ जब दो member को आपस में overlaping करके जोडा जा रहा हो तो इस प्रकार से बना हुआ weld joint ही fillet weld कहलाता है।

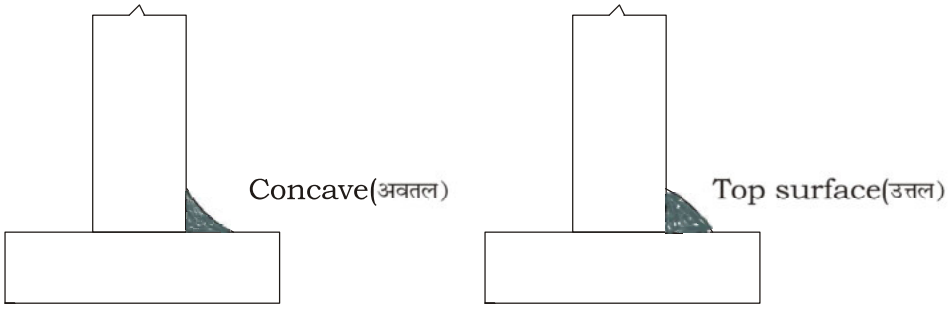
⇒ Fillet weld में members की overlaping 5t गुणा thickness thiner plate (5t) से कम नही होनी

चाहिए।

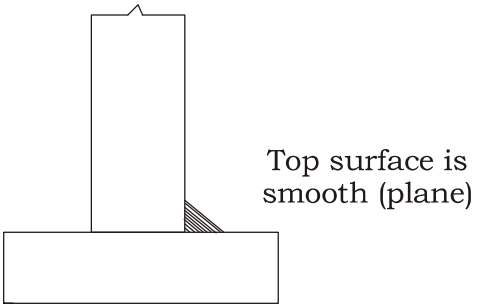
⇒ Fillet weld are classified at the mode of formation

⇒ इसके अनुसार fillet weld को तीन प्रकार से classified किया जाता है।

(1) Concave fillet weld
(2) Convex fillet weld
(3) Mitre fillet weld



Concave fillet weld Convere fillet weld



Mitre fillet weld

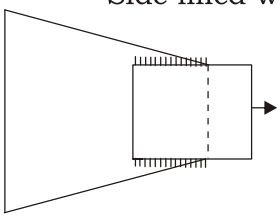
❖ Classification of fillet weld According there axcces [position]:-

⇒ इसके अनुसार fillet weld को तीन प्रकार से classified किया जाता है।

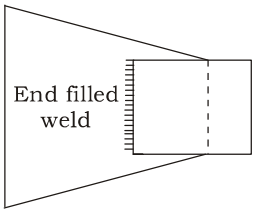
(1) Side fillet weld
(2) End fillet weld
(3) Diagonal fillet weld

(1) **Side fillet weld:-** A types of fillet weld whose axix is parallel to the aeuied load is called side fillet weld.

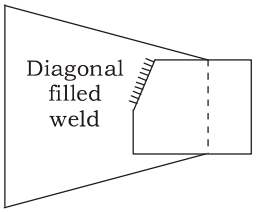
Side filled weld



(2) **End fillet weld:-** A types of fillet weld whose axix is perpendicular to the aeuid load is called end fillet weld.



(3) **Diagonal fillet weld:-** A type of fillet weld whose Axis inclined to the applied load is called diagonal fillet weld.



❖ **Strength of a fillet weld:-** The fillet are design for taking for shear.

⇒ Fillet weld shear को Resist करने के लिए design किया जाता है।

$P = P_q \times l \times t$

P = Shear strength capacity of fillet weld

P_q = permissible shear stress in fillet weld.

L = Effective length of fillet weld

t = throat thickness (t = k x s)

K = A cofficant with a depend on the coheabing angle b/w forsim sace to the major.

S = size to weld

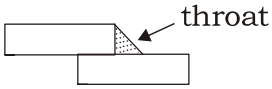
⇒ **Effective length:-**

L = over all length - 2x weld size

$L_{eff} = L - 2 \times s$

Note:- Effective weld length 4 x weld size (4s) से कम नही होनी चाहिए।

❖ **Throat of fillet weld:-**Fillet weld में throat सबसे ज्यादा कमजोर section होता है। अर्थात् fillet weld सबसे पहले यही से fail होता है और throat connect होने वाले member के right angle corner में weld के कर्ण तक की perpendicular distance होती है।



t = k x s

throat (t) = k x s

$$S = \frac{throat}{k} \Rightarrow \frac{t}{k}$$

❖ **Value of k**:- The value of k is depended the connecting angle b/w fals of the members so throat also depended the connecting angle b/w fushion fales.

Connection Angle between fusion facies	60 - 90	91 – 100	101 - 106	107 – 113	114 – 190
Value of k	0.70	0.65	0.60	0.55	0.50

Note:- Fillet weld में connection Angle b/w two member 60^0 से कम नही होना चाहिए। और 120^0 से अधिक नही होना चाहिए।

❖ **Size of weld:-**

Fillet weld design करते समय max. और minimum size of weld crite area निम्नानुसार लिया जाता है।

❖ **Minimum size of weld:-**

S.No.	Thickness of thicker plate	Minimum size of weld
1	If thickness of member up 10 mm	3 mm
2	If thickness of member over 10 mm & up to 20 mm (11 – 20 mm) तक	5 m
3	If thickness of member over 20 mm & upto 32 mm (20 – 32) mm	6 mm
4	If thickness of member over 32 mm & up to 50 mm [33 से 50 mm] rd	10 mm

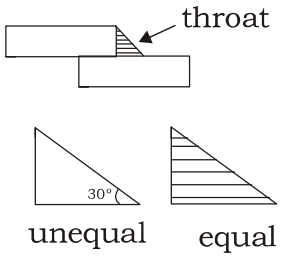
Note:- Minimum size of weld thickness of thicker मोटी plate की सहायता से ले ली जाती है।

❖ **Max. size of weld:-**

(1) For plate or Rectangular edge of weld = edge thickness - 1.5 mm

(2) For Rolled steel joist [T-section, I-section, channel section, Angle section]

$$= \frac{3}{4} \times thickness\, of\, leg\, [Edge]$$



⇒ If welding making 45^0 Angle with a plate [Horizontal] size of weld = equal to leg length of triangular

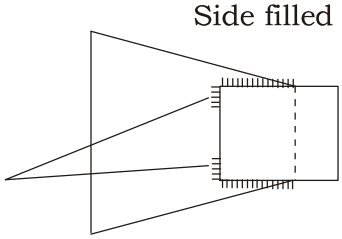
Note:-

यदि fillet weld triangle leg length equal हो तो size of weld triangle की length के बराबर होता है। ($\theta = 45^0$)

⇒ यदि triangle की leg length unequal हो तो size of weld smaller leg length of triangular के बराबर होता है।

❖ **End Return:-**

Side filled weld



⇒ यदि fillet करते समय केवल side fillet weld की जी रही हो तो उस conditions में end return करना आवश्यक होता है। और यह 2 x weld size(25) से कम नही होनी चाहिए।

❖ **Side fillet:-**

$$l \not< b$$

$$b \not> 16t$$

❖ **Intermidate fillet weld:-**

⇒ fillet welding करते समय जब available weld length requird weld length से ज्यादा हो तो उस condition में intermidate fillet की जाती है। इसके लिए निम्न cirte area adopte किये जाते है।

(1) The intermidate fillet weld length should not less than 4 x weld size or 40 mm even is greater.
(2) The clear between intermidate fillet weld in case of compression member should not exceed = 12t or 200 mm [which ever is lesser]
(3) tenison = 16t or 200 mm [which ever is lesser]

Note:-

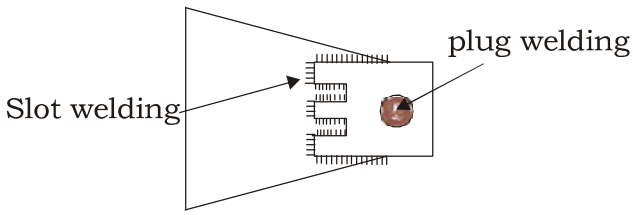
(1) यदि fillet welding field में की जा रही हो तो permissible stress reduce होकर 80% रह जाती है।
(2) यदि wind or earthquake load consider किये गये हो तो premissible stress 25% increase हो जाती है।

(1) **<u>Slot and plug welding:</u>-**

⇒ Slot or plug welding fillet weld का ही एक विशेष प्रकार होते है। और ये welding उस condition मे की जाती है जब Required weld length available weld length से अधिक हो।

❖ **<u>Slot welding:-</u>** यदि welding काटे गये खांचे पर की जा रही हो तो इस प्रकार की welding slot welding कहलाती है।

❖ **<u>Plug welding</u>:-** यदि welding के द्वारा काटे गये खांचे को पूरी तरह भर दिया जाऐ तो उस प्रकार से की गई welding plug welding कहलाती है।



⇒ Minimum diameter of slot = 3 x thickness of slotted member (3t) or 25 mm [Which ever is greater]
⇒ Minimum spacing between slot = 2 x thickness of solted member (2t) or 25 mm.

❖ **Butt weld:-**

⇒ यदि दो member को end to end connect किया जा रहा हो तो इस प्रकार से बना हुआ weld joint butt joint butt weld कहलाता है। इसे निम्न प्रकार से classified किया जाता है।

❖ **Size of butt weld**:- Size of butt weld are specified by effective throat thickness.

Case I:-

In case of compelte penetration of Butt weld (doubble, J-Butt, doubble v, doubble)

❖ **Doubble(v)** :- The effective throat thickness is take:- thickness of thinner member in jointed

Case IInd :-

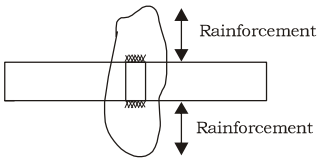
In case of incomplete, penetration [single v, single v, single j, single Bevel]

⇒ The effective throat thickness is taken :- $\frac{7}{8}$ x thickness of thinner member is jointed

Note:- far calculations of stress the effective throat thickness is taken = $\frac{5}{8}$ x thickness of thinner member jointed

In case of in complete Penetration.

❖ **Rainforcement:-**



Butt weld करते समय welded material के top surface से की गई extra wedling rainforcement कहलाती है।

⇒ Rainforcement की minimum value 10% of the thickness of welded material से कम नही होनी चाहिए।

⇒ जब joint पर static load आ रहे हो तो उस conditions में Rainforcement provide करने से joint की strongness बढ जाती है।

⇒ यदि joint पर vibration loading आ रही हो तो यह joint सबसे पहले Rainforcment से ही fail होता है। इसलिए vibration loading condition में Butt weld में rainforcement provide नही किया जाना चाहिए। अर्थात् weld की top surface को पहले rainforce करके flush कर दिया जाता है अर्थात् top surface को level कर दिया जाता है।

❖ **Advantage or disadvantage:-**

(1) **Advantage**

(i) In welded joint no hole required so structural member are more effective to taking load.
welded joint में member के अंदर hole नही किया जाता है। इसलिए load को effectively carry नही किया जाता है।

(ii) Welded joint के case में overall weigth of structure को कम किया जा सकता है।

(iii) Welded joint Rivet joint के compare में economical होता है।

(iv) Welded joint का approve बहुत अच्छा होता है।

(v) Fabrication speed रिवेट joint के very high

(vi) कोई भी आकर को आसानी से जोडा जा सकता है।

(vii) Welding process के लिए बहुत कम जगह की आवश्यकता हो।

(viii) Welding joint में Rigid joint बनता है।
(ix) Welded joint में noise pollution नही होता है।

❖ **Disadvantage:-**
(i) Skilled labour is required
(ii) Electricity is required
(iii) Fatigue strength is very less
(iv) The member are likely distort due to uneven heating and cooking.

S.No.	Rivet connection	Bolted connection
1	permanent fasteners	temporary fasteners
2	Economical	costly
3	Fabrication speed is low	fabrication speed is high
4	noise pollution is produced	no more pollution is produced
5	Riveted connection is used in case of vibration loading	Bolted connection can not used in case of vibration loading

Types of SECTIONS

❖ Roller steel section are classified in different types:-
(1) **I - section**
(i) **ISJD** = (Indian standard junior beam)
SC → (Indian standard column section)
(ii) **ISLB** → (Indian standard ligth night beam)
(iii) **ISMB** → (Indian standard medium night beam)
(iv) **ISHB** → (Indian standard heavy night beam)
(v) **ISWB** → (Indian standard nide flange beam)

A I-sectoin is designed by its depth or overall depth and nigth per running meter.
For eg. ISLB 500 @ 7358 N/M
↓ ↓
over all depth night per meter

(2) **Channel - Sections:-**
(i) ISPG → (Indian standard Gate channel)
(ii) ISJC → (Indian standard junior channel)
(iii) ISLC → (Indian standard light night channel)
(iv) ISMC → (Indian standard medium night channel with sloping flange)

A channel section is designed by its overall depth and night running meter.

Example:- ISMC 350 @ 223.70 n/m
↓
Over all depth in mm night per running meter

(3) Angle section
Angle section are classified as 3 types:-
eg.