1. A 18mm tk plate is joint to a 16mm plate by 200mm long [effective] butt weld. Determine the strength of the joint, if

(i) A double 'V' butt joint is provided

(ii) A single "V' butt joint is provided

Assume the grade Fe410 for the plates and for the welds which are shop welded

Given Data:-

L_e= 200mm

Grade of plate Fe=410

Fu = 410 N/mm^2

Weld:- Shop welded

Sln:-

(i) Double 'V' butt joint:-

Strength of weld = Design stress of weld X Eff. Area

= fwd x lw x t

$$f_{wd} = \frac{f_{wn}}{\gamma_{mw}}$$

$$f_{wn} = \frac{fu}{\sqrt{3}}$$

For double 'V' butt joint complete penetration of the takes place.

$$f_{wn} = 236.71 N/mm^2$$

$$f_{wd} = \frac{236.71}{1.25}$$

$$f_{wd} = 189.368 N/mm^2$$

Strength of weld = 189.368 x 200 x 16

= 605.977 KN

(ii) Single 'V' butt joint:-

t = 5/8 s [Incomplete Penetration]

= 5/8 x 16

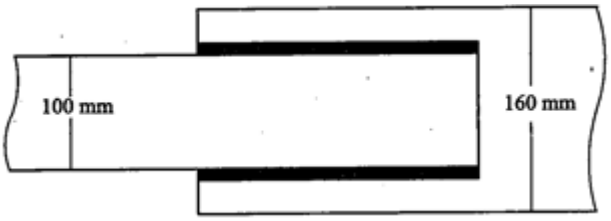
t = 10mm

$$\text{Strength of weld} = \frac{fu/\sqrt{3}}{\gamma_{mw}} \times lw \times t$$

= 189.368 x 200 x 10

Strength of weld = 378.74 KN

2. Design a suitable longitudinal fillet weld to connect the plates as shown in fig. The pull to be transmitted is equal to the full strength of the small plate. Given the plates are 12mm tk, grade of plates is Fe410 and welding is made in the factories.



Given:-

TKS of Plate = 12mm

Grade of Plate Fe410

$f_u = 410\ N/mm^2$

$f_y = 250\ N/mm^2$

The strength of the weld is equated to the design strength of the smaller plate.

Design strength of weld = $\frac{fu/\sqrt{3}}{\gamma_{mw}} \times lw \times t$

Mini size of weld = 5mm [from Table-21 pg.No:78]

Maxi size of weld = t_p- 1.5 = 12-1.5 = 10.5mm

Assume the size of weld = 10mm

t = 0.7s

= 0.7 x 10

t = 7mm

Strength of smaller plate [yielding criteria] = $\frac{fuAg}{\gamma_o}$

Where, $\gamma_o = 1.1$

Strength of smaller plate (yielding criteria) = $\frac{250 \times 1200}{1.1}$

= 272.72 KN

Strength of weld = $\frac{fu/\sqrt{3}}{\gamma_{mw}} \times lw \times t$

$272.72 \times 10^3 = \frac{410/\sqrt{3}}{1.25} \times lw \times 7$

$$lw = 205.7\ mm \simeq 205\ mm$$

Provide an over lap of 105mm.

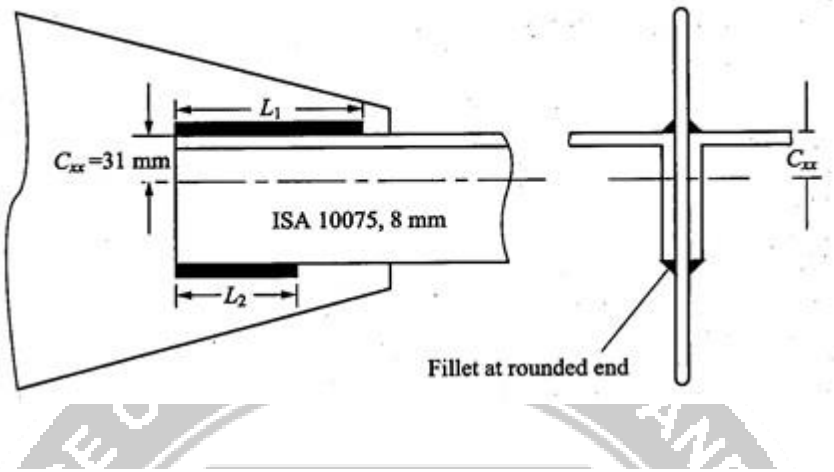
3. A tie member of a roof truss consist of 2Nos of ISA 100x75x8mm. The angles are connected to either side of a 10mm tk guset plate and the member is subjected to a working pull of 300KN. Design the welded connection. Assume the connections are made in the shop.

Given Data:-

Working load = 300KN

2 ISA 100x75x8mm

Tks of guset plate = 10mm



Sln:-

Factored load = 1.5x300
= 450 KN

Each ISA 100x75x8mm takes 450/2 = 225 KN

Min. size of weld = 3mm [From table-21 IS 800-2007]

Max. size of weld = 8-1.5
= 6.5mm

Also, max. size of weld (rounded edger) = 3/4 x 8 = 6mm

Throat tks, t = 0.7 x S [∵ Angle of fusion = 90^0]
= 0.7 x 6
t = 4.2mm

Strength of weld = Design stress of weld x Eff. Area

$$= \frac{fu/\sqrt{3}}{\gamma_{mw}} \times lw \times t$$

$$225 \times 10^3 = \frac{410/\sqrt{3}}{1.25} \times lw \times 4.2$$

$$\because lw = 282.89mm \simeq 283mm$$

Since the C.G of angle section does not lie at the centre of the connected leg, the weld length at top & bottom need to be such that the C.G of weld.

C.G of angle ISA 100x75x8 = 31mm from the outstanding leg.

<u>To find C.G of weld:-</u>

Let L1 = length of weld @ top
L2 = length of weld @ bottom

∴ For the C.G of the weld to lie at 31mm from the outstanding leg

$$\therefore L_1 \times 31 = L_2(100-31)$$

$$L_1 = 2.23l_2$$

$$L_1 \times L_2 = 283$$

$$2.23l_2 + l_2 = 283$$

$$3.23L_2 = 283$$

$L_2 = 87.62mm \ \text{¿} 90mm$

$L_1 = 195.39mm \simeq 200mm$

Provide 200mm length of weld @ the top and 90mm length of weld @ the bottom

∴ The min. over lap length is required 200mm

NOTE:-

In case the length of weld is limited, (length of overlap) end fillet weld can be provided which should also satisfy the condition C.G of weld = C.G of member.

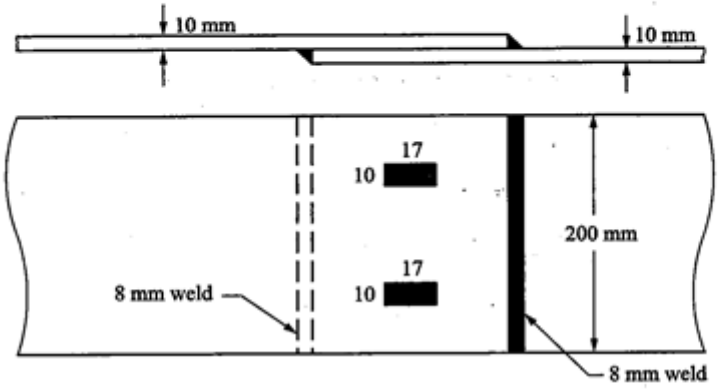
4. Design the welded connection to connect 2 plates of width 200mm & tks 10mm for 100% efficiency.

Given:-

Width of plate = 200mm

Tks of plate = 10mm

Efficiency = 100%



Sln:-

1. Strength of the solid plate:-

$$= \frac{fyAg}{\gamma_o}$$

$$= \frac{250 \times 200 \times 10}{1.1}$$

$$= 454.5 \text{ KN}$$

Mini. Size of weld = 3mm

Maxi. Size of weld = 10 -1.5=8.5mm

Assume size of weld as 8mm 78.5mm

Strength of the weld = Design stress of weld x Eff. Area

$$= \frac{fu/\sqrt{3}}{\gamma_{mw}} \times lw \times t$$

$$454.5\times10^3=\frac{410/\sqrt{3}}{1.25}\times lw\times0.7\times8$$

lw = 428.6mm

Total length available for weld l = 200+200

l = 400mm

Eff. Length available for weld, lew = l-2.5 x 2

= 400-2x8x2

lew = 368mm

To find strength of weld for 368mm:-

∴ End filled weld is provided for left = 368mm

∴ Design strength of weld for end fillet

$$=\frac{fu/\sqrt{3}}{\gamma_{mw}}\times lw\times t$$

$$=\frac{410/\sqrt{3}}{1.25}\times368\times5.6$$

Design strength of weld for end filled = 390.2KN

Strength of weld reqd. = 454.5-390.2 = 64.3KN

Additional weld is reqd. for this additional weld strength. Here slot weld or plug weld may be provided.

Provided plug weld, Area of plug weld read is,

$$\text{Area of plug weld reqd} = \frac{Additional Strength reqd.}{Design Stress of weld}$$

$$=\frac{64.3\times10^3}{\frac{410/\sqrt{3}}{1.25}}$$

$$Aw=339.5\,mm^2$$

∴ Provide one side of 10mm with 2 rectangular plug welds.

l_e of oneside = 10mm

∴ other side = 2(10)x = 339.54

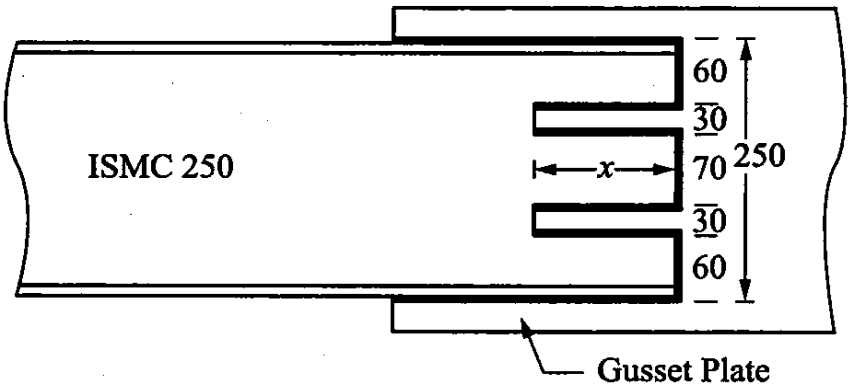
∴ x = 16.97mm

The channels are connected on either side a 12mm tk gusset plate. Design the welded joint to develop full strength of the tie member. The overlap is limited to 400mm.

Given Data:-

Tks of the plate = 12mm

Tie member = IS MC 250(2Nos)



Sln:-

ISMC 250 – Properties:-

$A = 3867mm^2$

$t_f = 14.1mm$

$t_w = 7.1mm$

Strength of solid Plate:-

Strength of solid plate [channel] = $\frac{f_y A_g}{\gamma_o}$

$= \frac{250 \times 3867}{1.1}$

$= 878.86KN$

∴ Strength of weld read $= 878.86KN$

Mini size of weld = 3mm [from table-21]

Maxi size of weld = 7.1-1.5=5.6mm

∴ Provide size of weld S = 4mm

∴ Throat tks, t = 0.7 x S

= 0.7 x 4

t = 2.8mm

Strength of weld = $\frac{f_u/\sqrt{3}}{\gamma_{mw}} \times lw \times t$

$878.86 \times 10^3 = \frac{410/\sqrt{3}}{1.25} \times lw \times 2.8$

lw = 1657.48mm

The available length along sides & end = 400+250+400 = 1050mm

[Since overlap is limited to 400mm]

[Either plug weld or slot weld can be provided]

Assuming 2 nos of 30mm wide to be provided along the end of the channel at equal spacing.

∴ Reqd length of slot = $\frac{1657 - 1050 + 2 \times 4}{4}$

= 153.75mm

∴ Length reqd. for the slot = 153.75mm

∴ Provide 2 slots of length 154mm