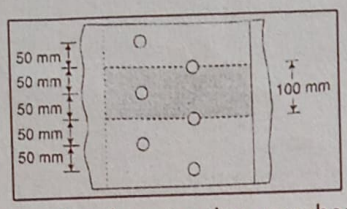
1. Determine the strength and efficiency of the lap joint shown in figure. The bolts are of 20mm diameter and of grade 4.6. The two plates to be jointed are 12 mm and 10 mm thick (steel is of grade Fe 410).

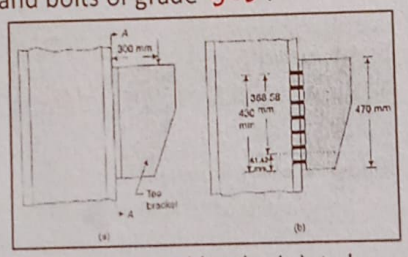


2. Design a double cover butt- joint splice for a tension member of section 200 x 8 mm using Fe410 steel. Determine the strength and efficiency of the splice connection.

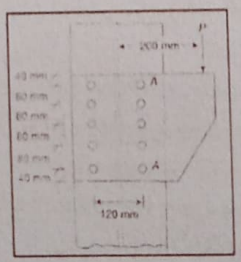
3. Find the safe load carrying capacity of a column pinned at both the ends. The section used for the column member is ISMB400@ 61.6kg/m. The length of column is 5 m.

4. A double cover butt joint, is to be provided for connecting two 12 mm and 20 mm thick plates of suitable width in grade Fe410 steel carrying tensile load of 800 kN. Design the joint using 20mm nominal diameter black bolts of grade 5.8 for the connection and determine the efficiency.

5. Design a bracket connection to transfer an end reaction of 300 kN due to factored loads as shown in figure. The end reaction from the girder acts at an eccentricity of 300mm from the face of the column flange. Design bolted joint connecting the tee flange with the column flange. Steel is grade Fe 410 and bolts of grade 5.6 .



6. Determine the safe load P that can be carried by the joint shown in figure. The bolts used are 20 mm diameter of grade 4.8 . The thickness of the flange of I sections is 9.1mm and that of bracket plate 10 mm.



7. A tie member consisting of an ISA 80 mm x 50 mm x 8 mm (Fe 410grade steel) is welded to 12 mm thick gusset plate at site. Design welds to transmit load equal to the design strength of the member.

8. A tie of heavy bridge consisting of ISMC300 @35.8kg/m in Fe410 grade steel is to be connected in the field to 12 mm thick gusset plate through its web using fillet welds. Design a welded connection when the overlap length is limited to 250mm.

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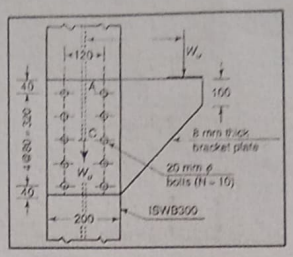
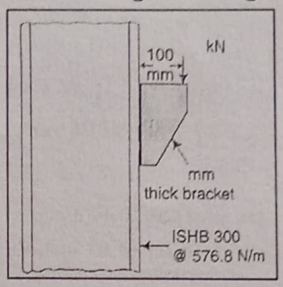
9. A bolted bracket connection consists of two bracket plates connected to the flanges of ISWB300 column. Each plate is connected to a column flange by black bolts of grade 4.8. Design the bracket connection when it supports a concentrated factored load of 225 kN per bracket plate at an eccentricity of 300 mm as shown in figure. The rolled column section and plates are in Fe410 grade steel.



10. A bracket plate 10 mm thick is used to transmit a reaction of 250 kN at an eccentricity of 100mm from the column flange as shown in figure. Design the weld.



11. Design a hanger joint along with an end plate of Fe410 grade structural steel to carry a load of 450 kN. The end plate is to be connected to a 400 mm wide bottom flange of built-up beam with four grade 8.8 HSFG bolts.

12. Design a 10 m long tension member subjected to a factored tensile load of 1250 kN (due to gravity load). The section should consist of 2 channels facing each other. The roll channels ISMC300 @ 358N/m only are available. Assuming the channels to be weakened by one bolt hole only, check the adequacy of the section. Design also plates on flange if required. Use Fe410 grade of steel. The bolts are used are of grade 4.6 and 16mm diameter.

13. Design a 5.5 m long single angle tension member to support dead tensile working load of 180 kN and a live tensile working load of 175 kN. The member is to be connected to the gusset plate through one leg with 20mm diameter bolts (at least four in a line @ 70mm centre to centre). The slenderness ratio should not exceed 300. The structural steel I of the grade E250 (410-S) as per the IS:226-1975.

14. Design a splice for joining tension member section 160mm x 10 mm and 250mm x 10 mm. the member is subjected to a factored tensile load of 300 kN. Assume Fe 410 grade of steel. Provide 20mm diameter bolts of grade 5.6 for making the connections.

15. Design a battened column with two channels back-to-back of length 5 m to carry an axial factored load of 1210 kN. The column is restrained in position but not in direction at both the ends.

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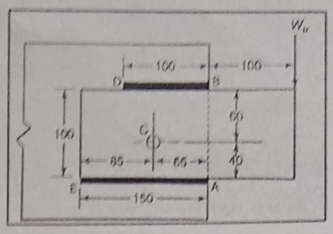
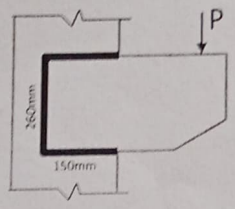
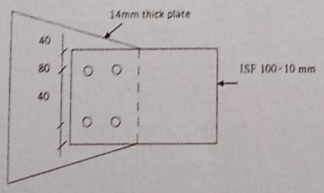
16. Design a laced column with two channels front to front of length 6 m to carry an axial factored load of 700 kN. The column is restrained in position but not in direction at both the ends.
17. A bracket plate attached to a column flange by two side fillet welds is used to transfer factored vertical reaction of beam of 80 kN as shown in figure. Determine the size of the weld required to resist the load.



18. A bracket plate is welded to the flange of a column ISHB200 as shown in figure below. The weld group is subjected to in-plane loading at a distance of 110 mm from the face of the column. Determine the maximum service load (p) it can carry if 5 mm size weld is used.



19. For the connection as shown below, four M20 bolts of grade 5.6 with threads in the shear plane to connect an ISF 100×10 mm with gusset plate is used in connection. Determine the strength of joint if, (a) Slip is not permitted at ultimate load, and (b) Slip is permitted at service load. Block shear strength need not be considered. (All dimensions are in mm)



20. An ISA 125 x 95 x 10 mm thick steel angle tie is to be connected by its top and bottom edges only to a 10mm thick gusset plate using 5 mm size fillet weld as shown in the figure below. The yield and ultimate tensile strength of steel and weld are 250 Mpa and 410 Mpa. The welding is done at workshop. What are the possible combinations of top and bottom weld length.