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UNIT 2

BT 205: Engineering Mechanics

Riveted Connections, Types of joints, strengths and efficiency

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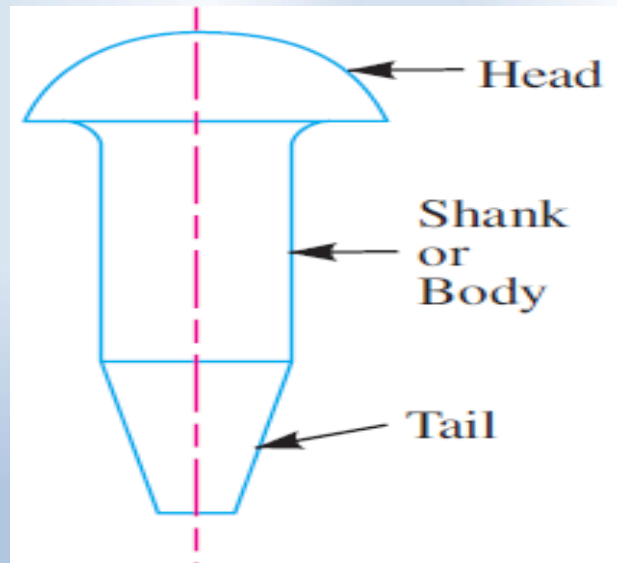
Semester: 2nd

Program: B.Tech CSE

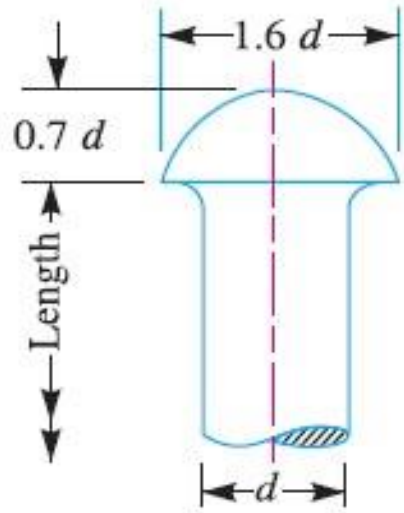
Year: 2020

Introduction

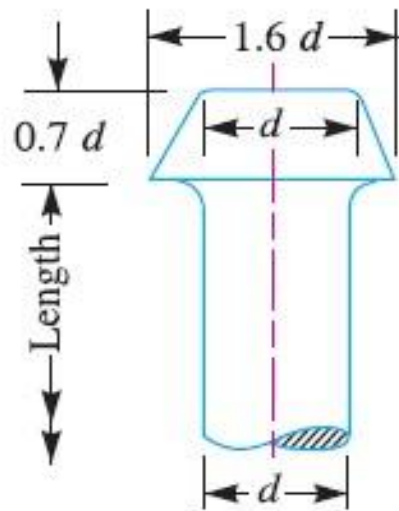
- A rivet is a short cylindrical bar with a head integral to it. The cylindrical portion of the rivet is called ***shank or body***
- and lower portion of shank is known as ***tail***.
- The rivets are used to make permanent fastening between the plates such as in structural work, ship building, bridges, tanks and boiler shells.
- The riveted joints are widely used for joining light metals.



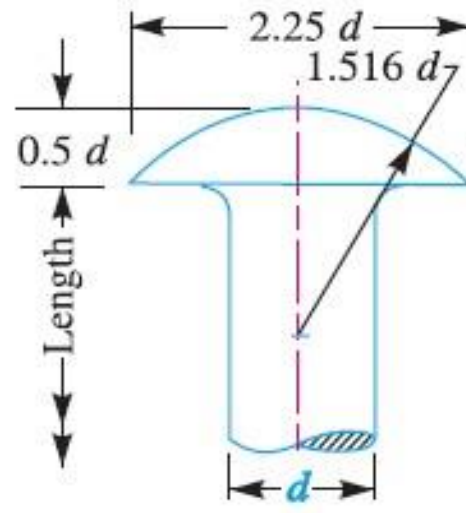
Types of Rivet Heads



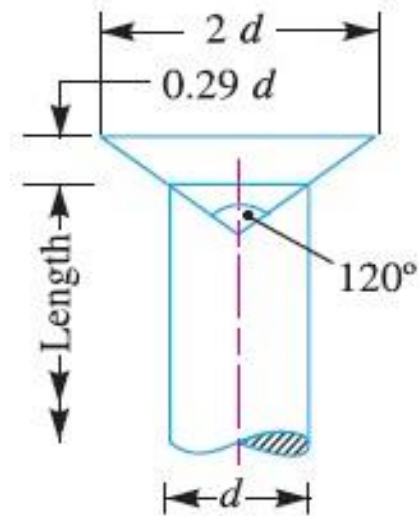
(a) Snap head.



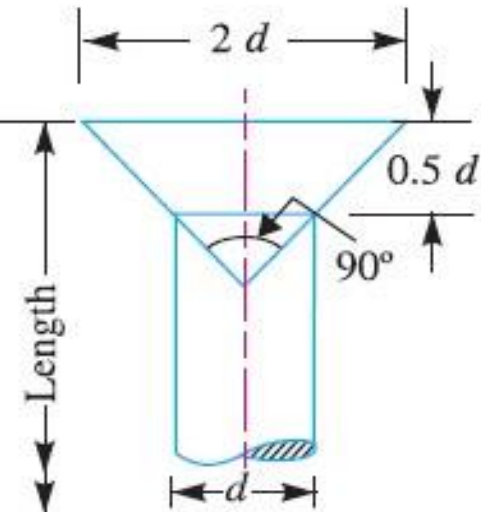
(b) Pan head.



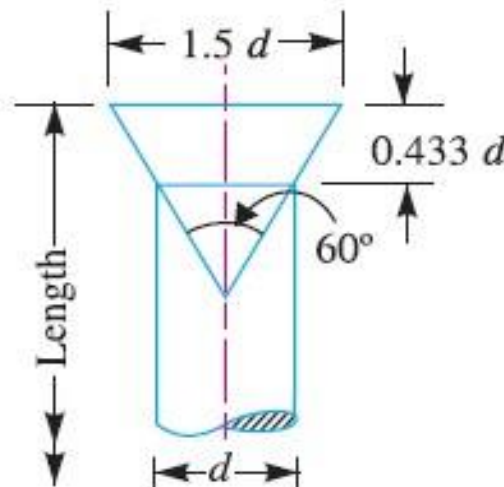
(c) Mushroom head.



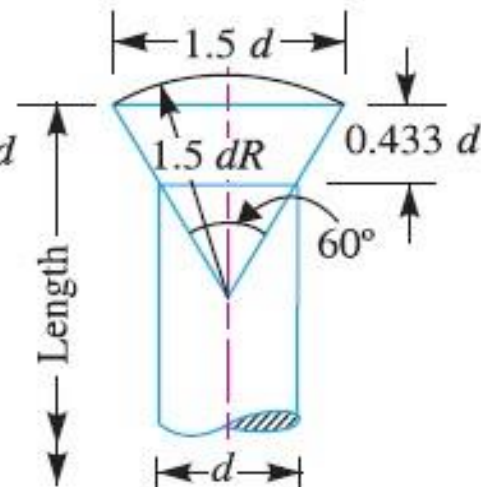
(d) Counter sunk head 120°.



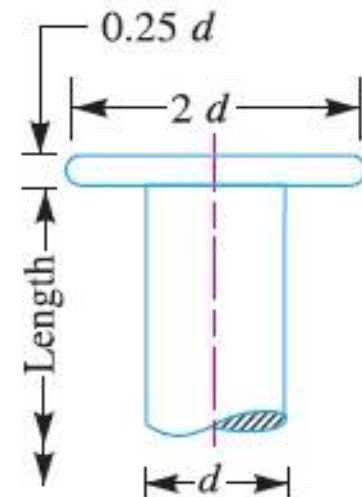
(e) Flat counter sunk head 90°.



(f) Flat counter sunk head 60°.



(g) Round counter sunk head 60°.



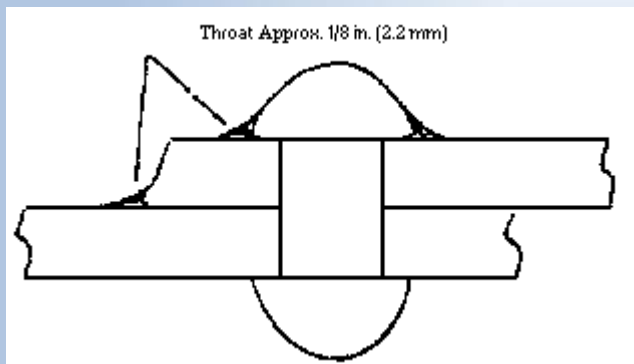
(h) Flat head.

Types of riveted joints

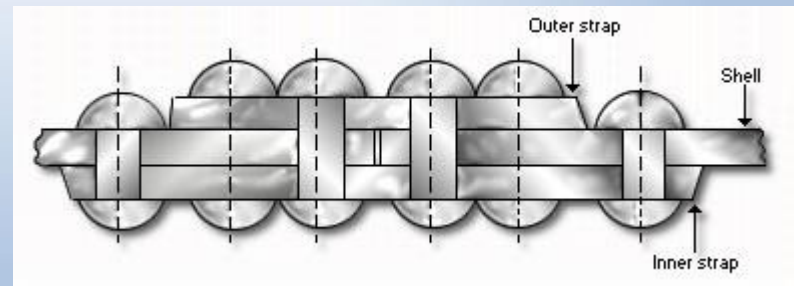
1. Lap joint

2. Butt joint

- Lap joint: A lap joint is that in which one plate overlaps the other and the two plates are then riveted together.
- Butt joint: A butt joint is that in which the main plates are kept in alignment butting (*i.e. touching*) each other and a cover plate (*i.e. strap*) is placed either on one side or on both sides of the main plates. The cover plate is then riveted together with the main plates.



Lap joint



Butt joint

Proportions of dimensions of riveted joints

- *Thickness of plate*
 $t = \text{Thickness of the plate}$
- *Diameter of rivets.*

the diameter of the rivet hole (d) may be determined by using

$$d = 6\sqrt{t}$$

- Types of Riveted joints

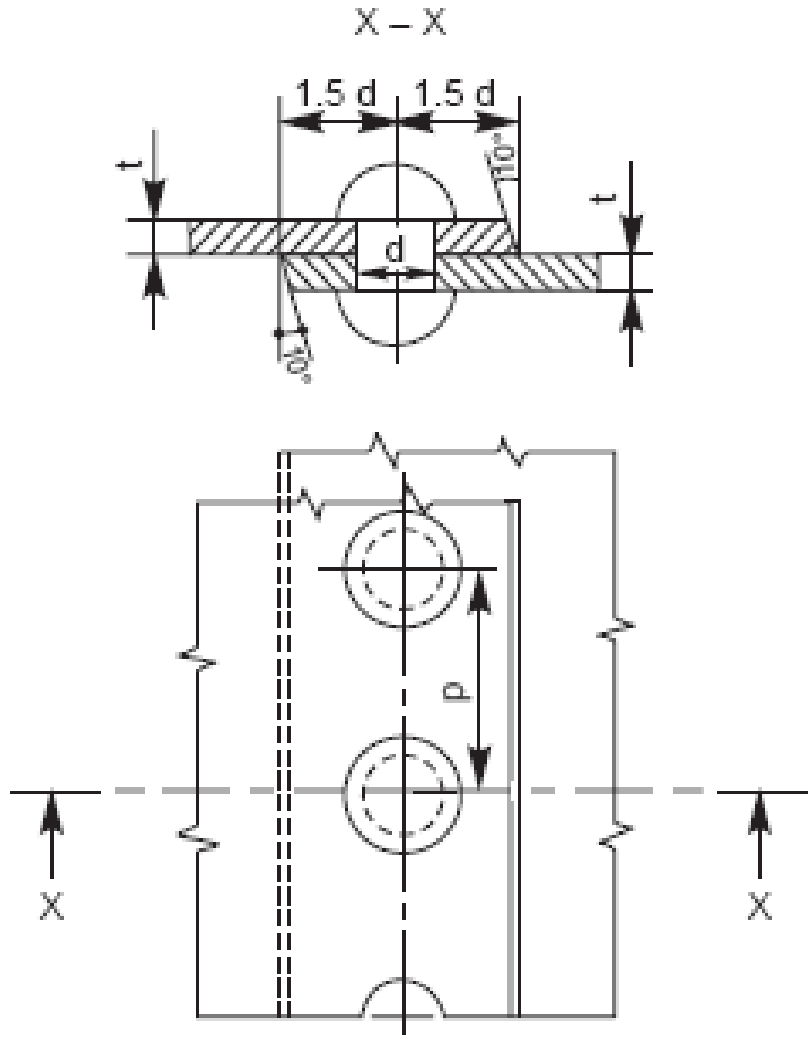
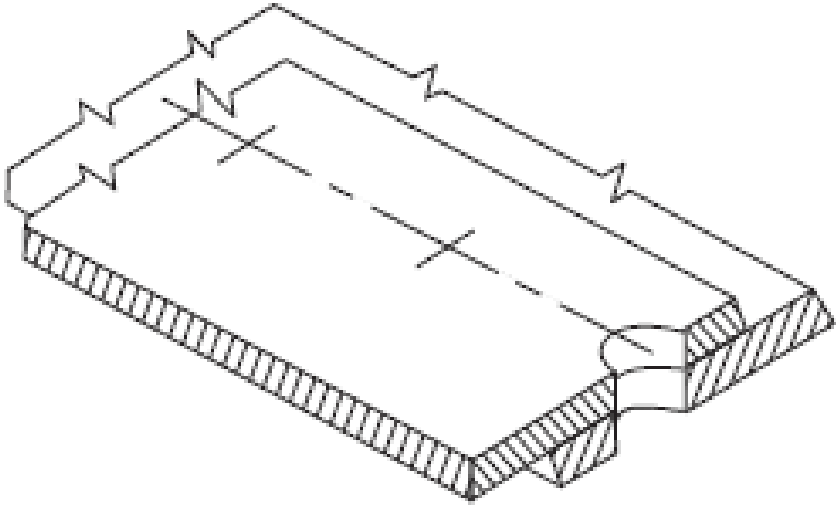


Fig. 10.9 Single riveted lap joint

- Double Riveted lap joints

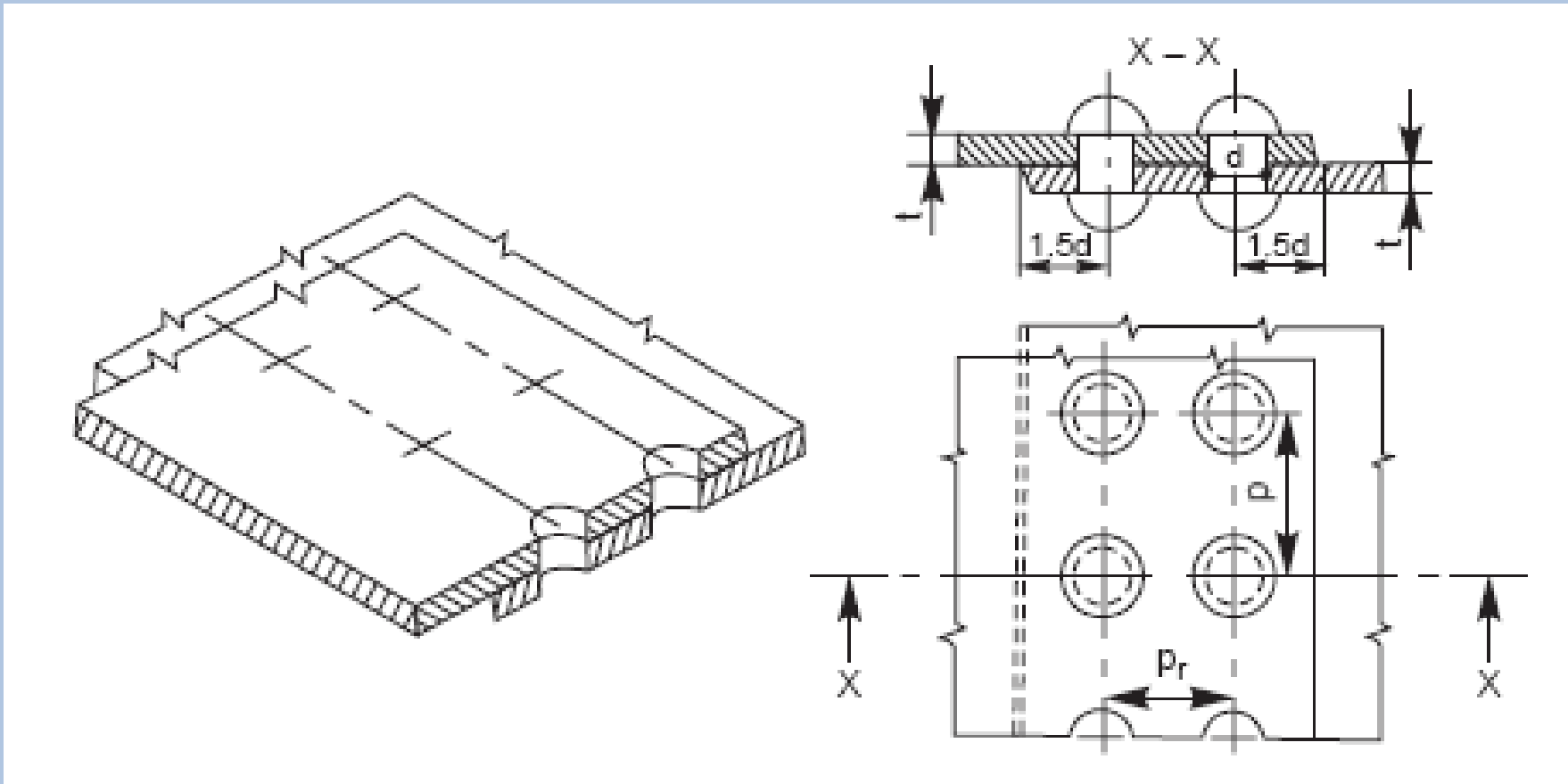


Fig. 10.10 Double riveted chain lap joint

- Double Riveted Zig zag Lap joint

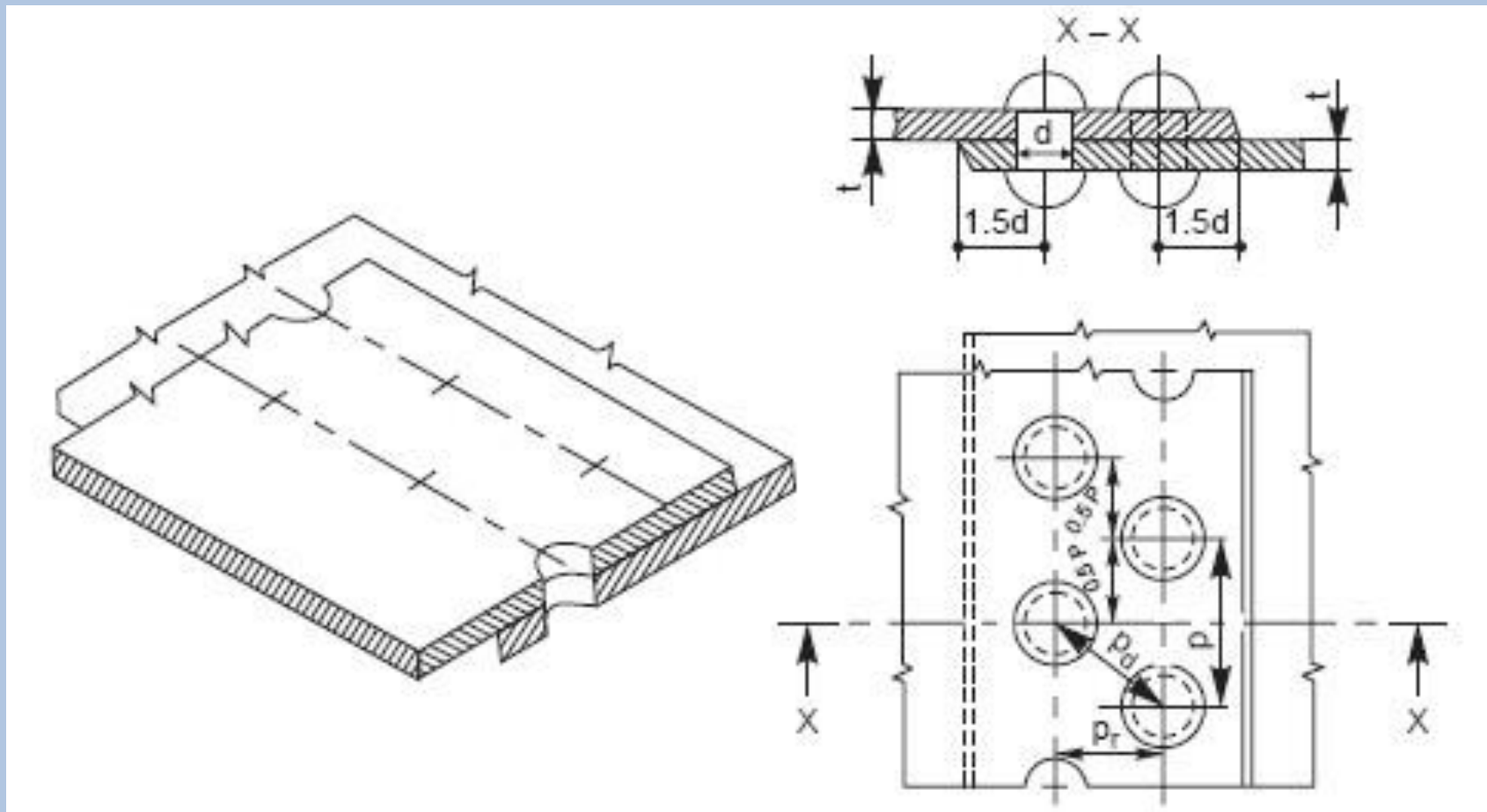


Fig. 10.11 Double riveted zig-zag lap joint

- Single riveted, single strap butt joint

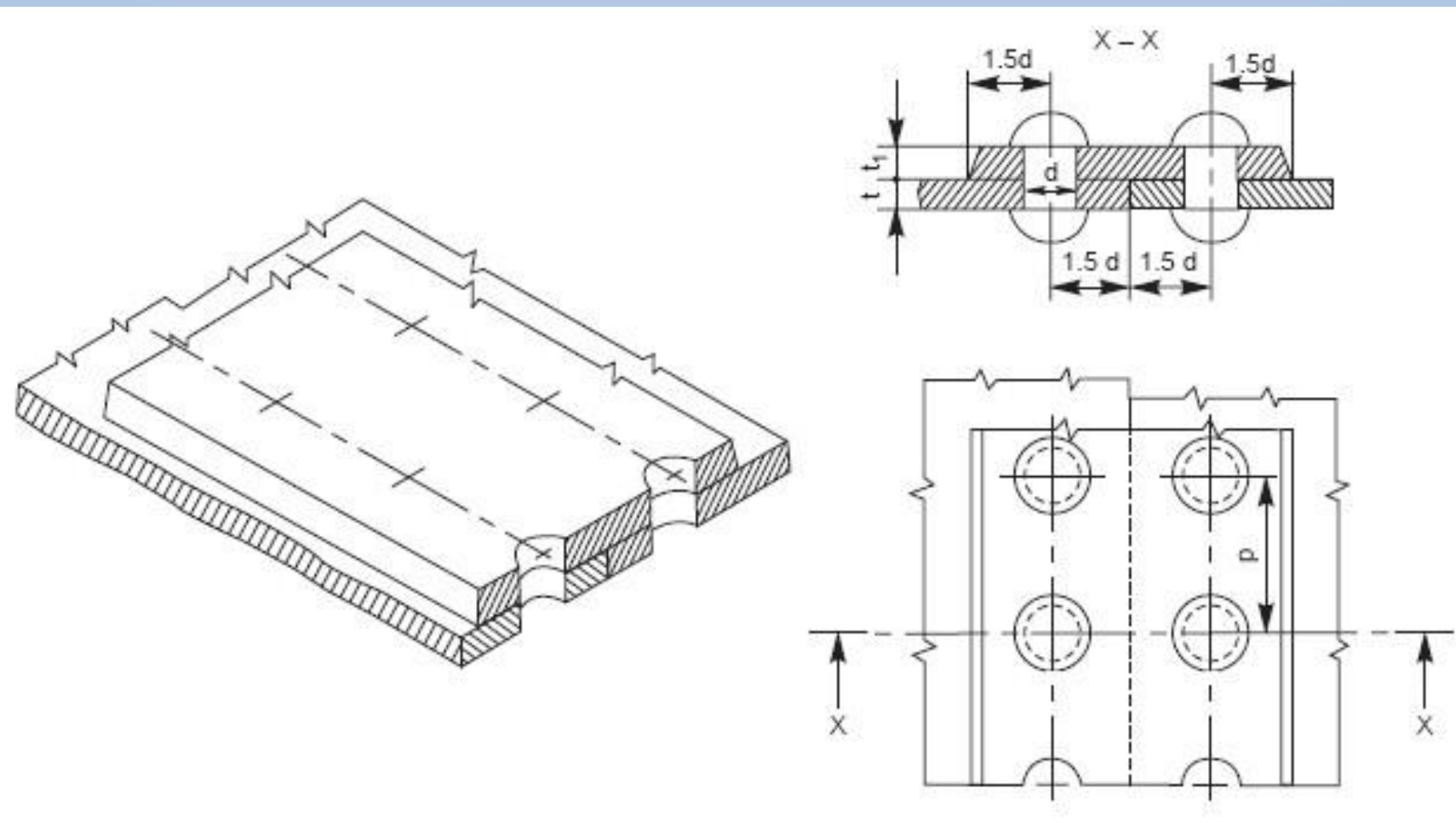


Fig. 10.12 Single riveted, single strap butt joint

- Single riveted, double strap butt joint

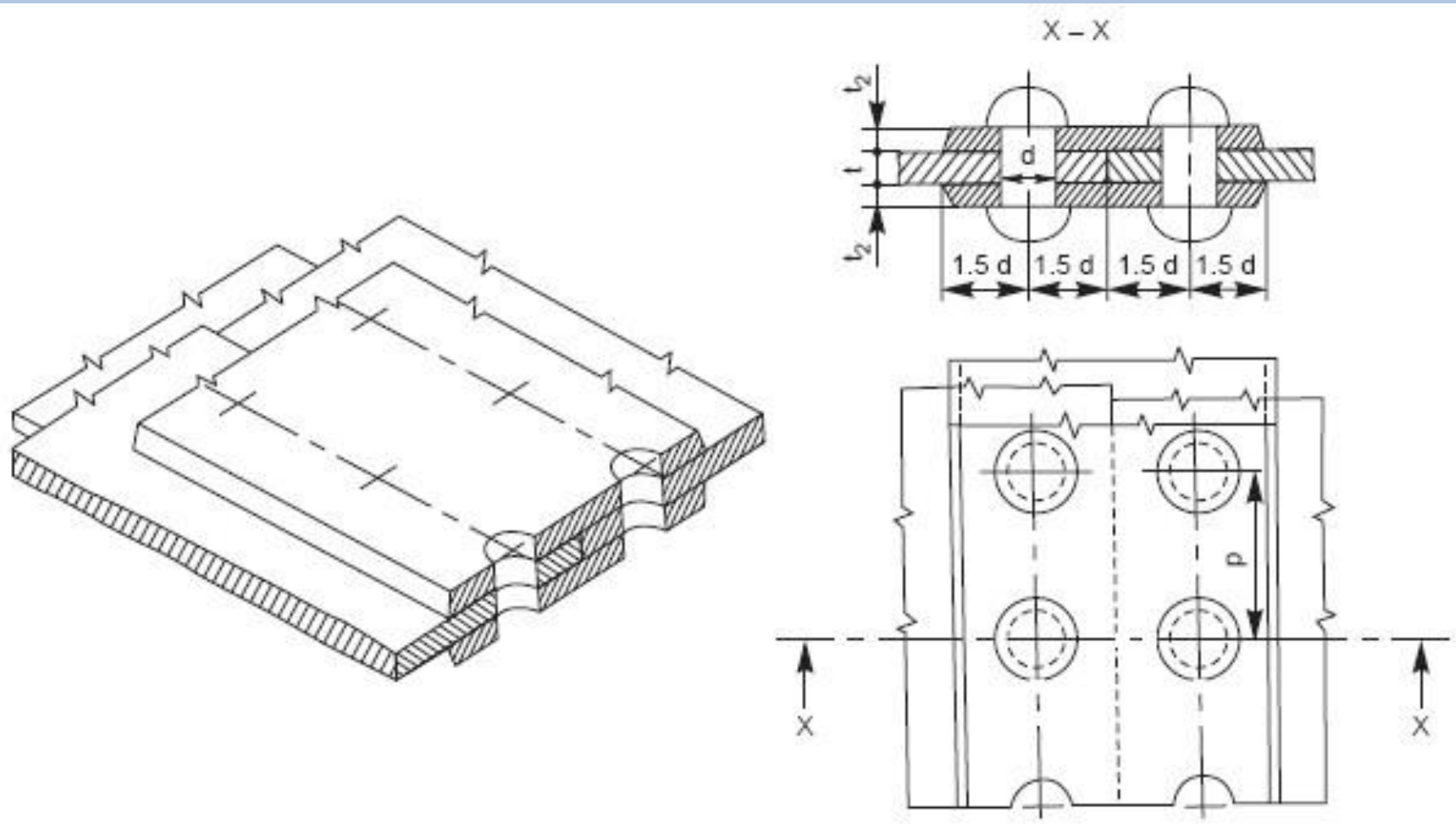


Fig. 10.13 Single riveted, double strap butt joint

- Double riveted, double strap chain butt joint

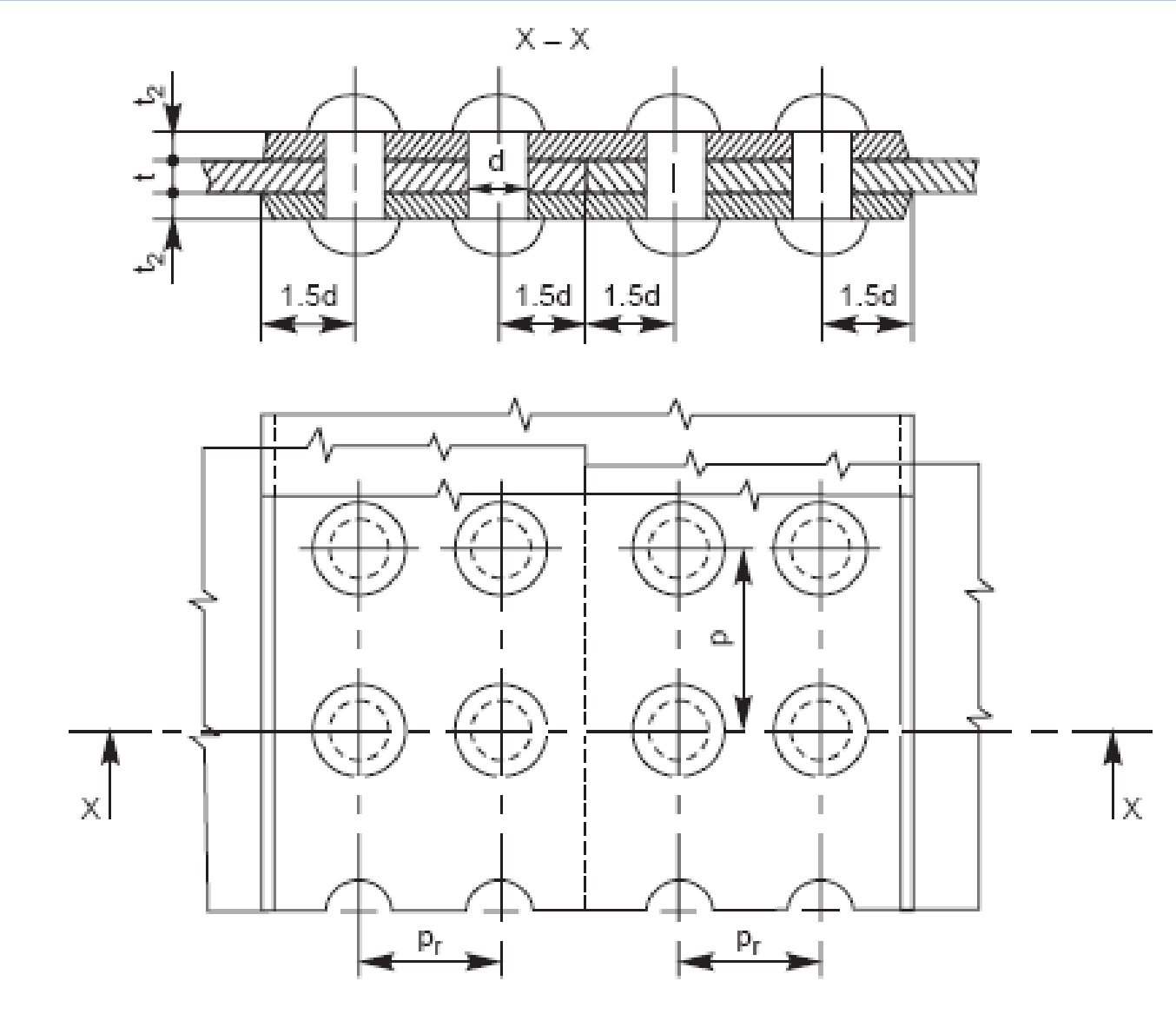


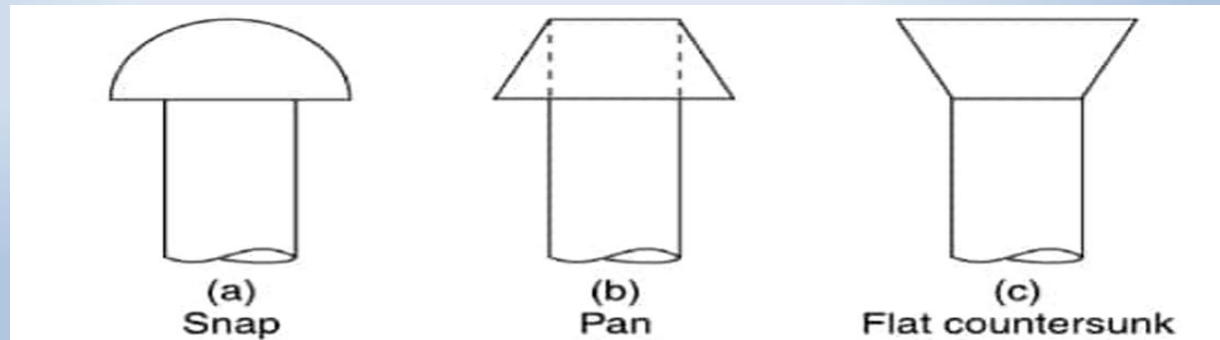
Fig. 10.14 Double riveted, double strap chain butt joint

WHAT IS RIVET CONNECTION?
TYPES OF RIVETED JOINTS..
STRENGTH OF RIVETED JOINTS..
EFFICIENCY OF RIVETD JOINTS..



RIVETED CONNECTION

- A rivet is made up of a round ductile steel bar piece (mild or high tensile) called shank, with a head at one end.
- The head can be of different shapes as shown in fig.
- The usual form of rivet head is snap head.
- The shank is made of the length to extend through the parts to be connected and with sufficient extra length for a second head to be made at the other end.



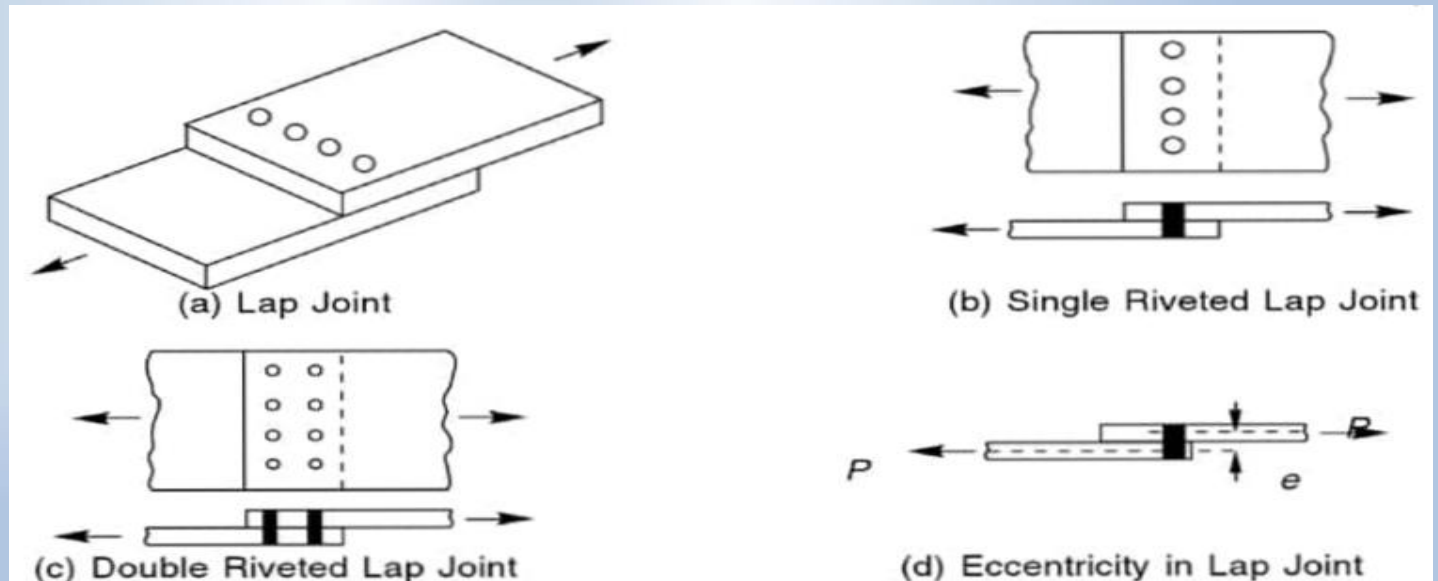
- The grip of the rivet is the shank length inside the connection.
- The diameter of the shank is called **nominal diameter**.
- A hole slightly greater than nominal diameter in the parts to be connected.
- The rivet is inserted and the head is formed at the other end. This complete process is called **riveting**.
- The rivets may be placed in a cold state or may be heated to a red hot state
- The diameter of the hole is called **gross diameter**.

TYPES OF RIVETED JOINTS

There are two types of riveted joints :

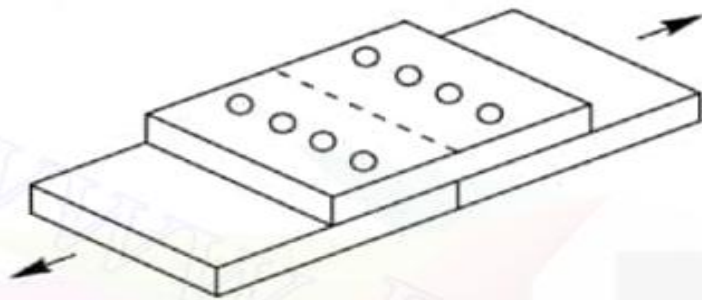
1. Lap Joint: When the two members to be connected are overlapped and connected together , such a joint is called lap joint as shown in fig.

A single riveted lap joint and a double riveted lap joint are also shown in fig.

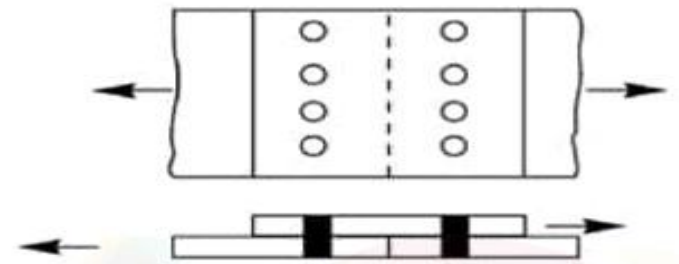


- **2. Butt Joint:**

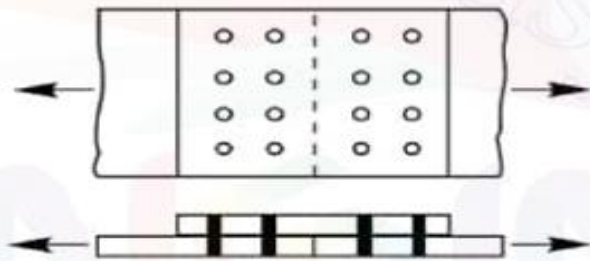
- When two members to be connected are placed end to end, additional plate/plates provided on either one or both sides called cover plates and are connected to the main plates as shown in fig. e and h
- If the cover plate is provided on one side as shown in fig. e,f and g, it is called **single cover butt joint**
- but if the cover plates are provided on both the sides of main plates, it is called a **double cover butt joint** as shown in fig h, i and j, next.



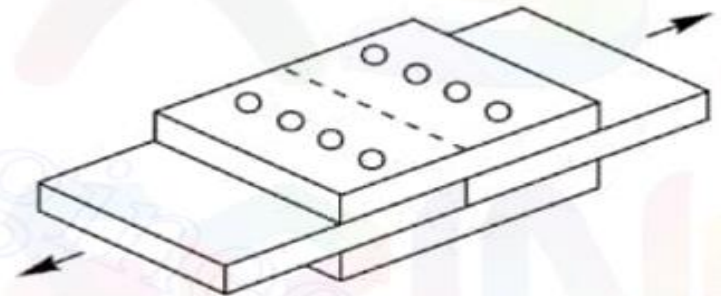
(e) Single Cover Butt Joint



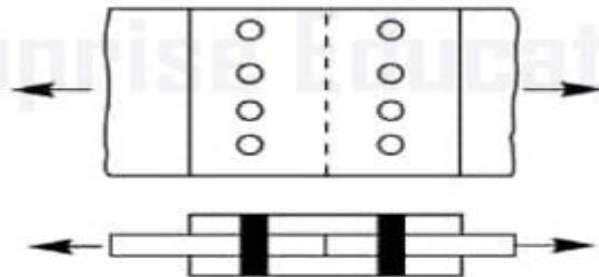
(f) Single Riveted Single Cover Butt Joint



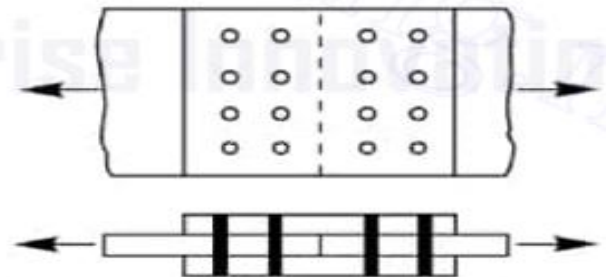
(g) Double Riveted Single Cover Butt Joint



(h) Double Cover Butt Joint



(i) Single Riveted, Double Cover Butt Joint



(j) Double Riveted, Double Cover Butt Joint

Strength Of Riveted Joint

1. Strength of rivet in shear: Shearing Strength

Strength of rivet in shear = cross-sectional area of shank \times permissible shear stress.

Single shear

$$\text{Strength of one rivet} = \frac{\pi}{4} d^2 \tau_{vf}$$

$$\text{Strength of riveted joint} = n \frac{\pi}{4} d^2 \tau_{vf}$$

$$\text{Strength of riveted joint/pitch length} = n' \frac{\pi}{4} d^2 \tau_{vf}$$

Double shear

$$\text{Strength of one rivet} = 2 \frac{\pi}{4} d^2 \tau_{vf}$$

$$\text{Strength of riveted joint, } P_s = 2 n \frac{\pi}{4} d^2 \tau_{vf}$$

$$\text{Strength of riveted joint/pitch length} = 2 n' \frac{\pi}{4} d^2 \tau_{vf}$$

- **P_s** =strength of riveted joint in shear
- **d** = gross diameter of rivet in mm
- **T_{vf}** = permissible shear stress in rivet
- **n** = no. of rivets on each side of joint
- **n'** =no. of rivets in one pitch length

2. Strength of rivet in bearing: Bearing strength

The bearing strength of rivet is the force that can be exerted on it by the section through which it passes .

Strength of rivet in bearing= projected area × permissible bearing stress

3. Strength of plate in tearing: Tearing strength

The strength of plate in tearing depends upon the net section resisting the force.

- Rivet value: The minimum strength of rivet in shear or bearing is called rivet value.

EFFICIENCY OF A RIVETED JOINT

It is the ratio of the strength of the joint to the strength of the main member expressed as a percentage.

- $\eta = \frac{\text{strength of riveted joint}}{\text{strength of solid plate}} \times 100$

End