Rivets and riveting

Objectives : At the end of this lesson you shall be able to

- **define rivets**
- **specify rivets**
- **name the materials from which rivets are made**
- **name the different types of rivets and state their uses.**

Rivets are used to join together two or more sheets of metal permanently. In sheet metal work riveting is done where:

brazing is not suitable,

the structure changes owing to welding heat,

the distartion due to welding cannot be easily removed etc.

Specification of rivets

Rivets are specified by their length, material, size and shape of head.

Rivets

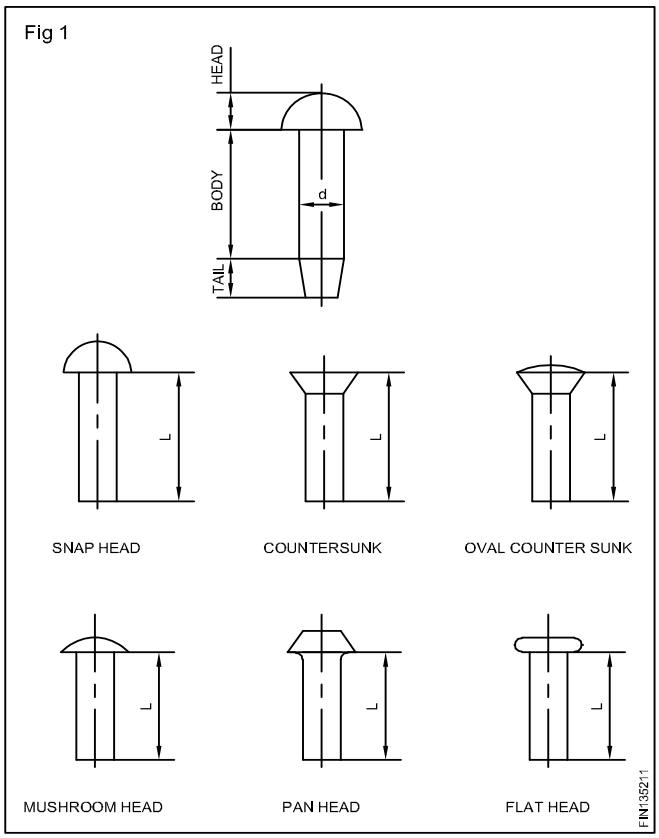
There are various kinds of rivets as shown in Fig 1. Snap head rivets, countersink rivets and thin bevelhead rivets are widely used in sheet metal work.

Material:

Rivets are made of ductile materials like low carbon sheet (mild steel), brass, copper, yellow brass, aluminium are their alloys.

The length of the rivets 'L" is indicated by the shank length. (Fig 1)

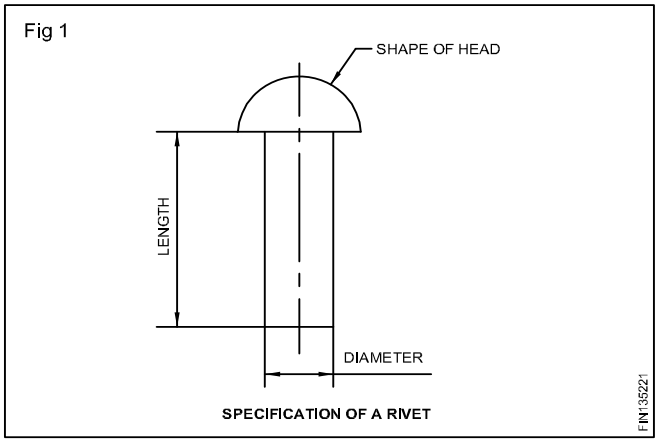
Fig 1



Rivets are cylindrical rods having heads of various shapes.They are used for assembling the parts of a workpiece together.

Parts of the rivet (Fig 1)

Fig 1



Shape of head

The shape of the rivet head is to be selected according to the intended use of the workpiece to be riveted.

Diameter

The diameter is to be selected depending on the required strength.

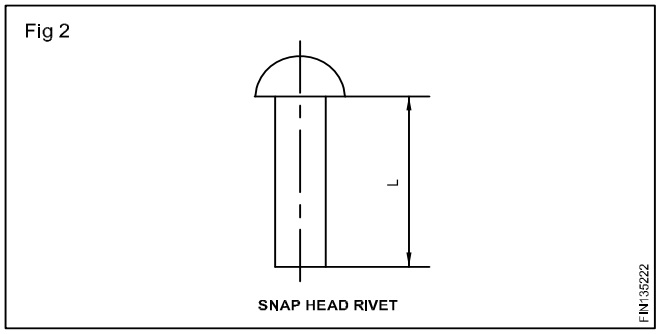
Length

Length is to be selected depending upon the thickness of the components to be riveted.

Types and uses

Snap head (Fig 2)

Fig 2

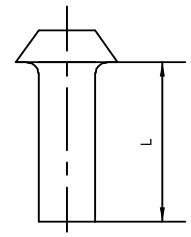


It is the most commonly used form, and it gives a very strong joint.

Pan head (Fig 3)

It is used in heavy structural work where the strength of rivet is very important.

Fig 3



PAN HEAD RIVET

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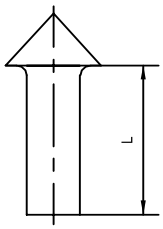
Conical head (Fig 4)

It is generally used in light assembly where riveting is done by hand hammering.

Fig 4



CONICAL HEAD RIVET

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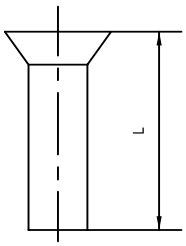
Countersunk head (Fig 5)

It is used where projection of the rivet head is to be avoided.

Fig 5



COUNTERSHANK HEAD RIVET

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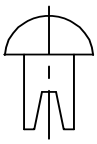
Bifurcated rivet (Fig 6)

The shape of the head is shown in the figure and the bifurcated portion is used for fastening light parts- tin plates, leather, plastics, etc.

Fig 6



BIFURCATED HEAD RIVET

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Riveted Joint

Objectives: At the end of this exercise you shall be able to

- **define 'riveting'**
- **state the use of riveting**
- **name the materials from which rivets are made**
- **name the different types of rivets used in sheet metal work**
- **follow rules and formulas for riveting process**
- **Name the orienting process**

Riveting: Riveting is one of the methods of making permanent joints of two or more pieces (Metal strips). It is customary to use rivets of the same metal as that of the parts that are being joined together.

Uses: Rivets are used for joining metal sheets and plates in fabrication work, such as bridges, ship building, games, structural steel work.

Types of rivets:

Tinman's rivet

Flat head rivet

Round head rivet

Countersunk head rivet

Each rivet consists of a head and cylindrical body.

Sizes of rivets: Sizes of rivets are determined by the diameter and length of the shank.

Selection of rivet size: The diameter of the rivet is calculated by using the formula D= (21/2 to 3) xT where T is total thickness

Lapping allowance: Normally in sheet metal trade, we will use the following formula that is Three times of the dia of rivet +2 times the sheet thickness on thin sheets

Pitch allowance: Three or four times the diameter of rivet +Sheet thickness 1 time

The shank length is given by

Length :- L= T+D where T is the Sheet thickness and D is the diameter of the rivet.

Normally Tinman's rivets are designated by numbers.

Thickness of sheet 14, 16, 18,20,22,25

Dia of rivet 22, 24,26, 27, 28, 30

Sketch

Draw a straight line of 1.25" and add sheet thickness, for total distance find out centre, and draw a semi circle with spring divider, Draw a perpendicular line projecting the line upto semi circle the distance is taken as a dia of rivet.

Rivet hole size and clearance: A rivet hole should be formed a little bigger than the nominal diameter of the rivet.The hole diameter will be bigger than the rivet shank nominal diameter by 0.2 to 0.3 mm for cold riveting and by 0.5 to 1.5mm for high temperature (Red) for hot riveting process.

Working condition

Cold Riveting

Hot Riveting Process

Rivet Nominal

2 3 4 5 -6

8 10 12 15 15 to 40

diameter (MM)

Tolerance (DA)

0.2+ + 0.2 +0.5-0.2+0.5-0.2

0.2++0.2

Bigger than nominal diameter

by 1.5 to 2.0 mm plates.

Hole diameter

2.2 3.2 4.2

8.5 11 13 16.5

5.3 6.3

Annealing of rivet: Riveting is usually performed in the normal temperature when the rivet diameter is less than 6mm. To prevent the breakage and failure of rivets and to faciltates the operation, rivets are used in the normal temperature. Rivets are annealed in the temperature of 650° C to 700°C and allow them to cool slowly. Generaly M.S Rivets are heated in furnaces uniformly. Aluminium rivets are used without annealing. High strength aluminium alloyed Rivets in the Duralumin group are heated to 480°C adn 500°C and, coded in water. Generally Electric furnaces are used for heating the rivets.

Method of riveting: Riveting may be done by hand or to machine. While riveting by hand it can be done with a ball pane hammer and a rivet set.

Rivet set: The shallow, cup shape hole is used to draw the sheet and the rivet together . The output on the side allows the slug to drop out.

The cup strap is used for forming the rivet head. The set selected should have a hole slightly larger than diameter of the rivet.

Spacing of rivets: The space of distance from the edge of the metal to the centre of any rivet should be atleast the twice diameter of the rivet to avoid tearing.

The maximum distance should never exceed 24 time thickness of the sheet. Otherwise buckling will take place.

Rivets proportions

Objectives: At the end of this lesson you shall be able to
- **determine the hole sizes for different diameters of rivets**
- **choose the rivet diameters according to the thickness of the plates/sheets**
- **calculate the length and rivet interference for different diameter rivets and plate sizes.**

Riveting: In order to produce efficient and good quality riveted joints the following aspects are important.

The size of the hole drilled for inserting the rivets.

The diameter of the rivet in proportion to the thickness of the plates/sheets to be joined.

The length of the rivet according to the type of the rivet and the thickness of the plates/sheets.

The size of the rivet and hole: The size of the hole to be drilled is according to the diameter of the rivet used.

A formula generally used for determining the diameter a solid rivet is

D.Min = T

to D.Max = 2T

The actual value used will depend upon the actual joint features and service conditions.

The size of the hole has to be slightly larger than the nominal diameter of the rivet. (Table 1)

For hot working, rivets will have holes with more clearance than for cold working.

TABLE 1
Hole diameter for rivets

Rivet nominal dia	2	3	4	5	6	8	10	12	15	15-40
Hole dia	2.2	3.2	4.2	5.3	6.3	8.5	11	18	16.5	Holes larger than the nominal dia by 1.5 to 2.0 mm

Length of rivets: The length of a rivet is the shank length. This will vary according to the thickness of the plates to be riveted and the type of the rivet head.(Fig 1 & 2)

Fig 1

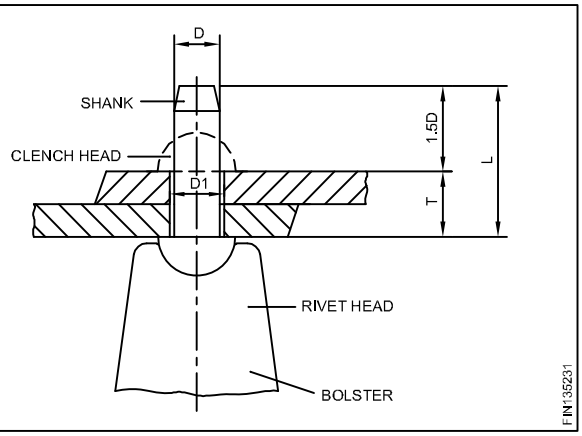
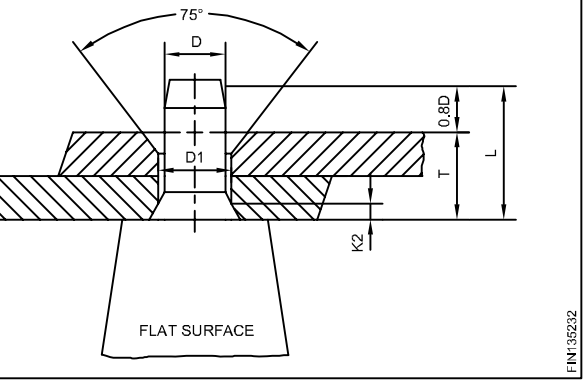


Fig 2



A formula generally used in the shop floor is length of snap-head rivets.

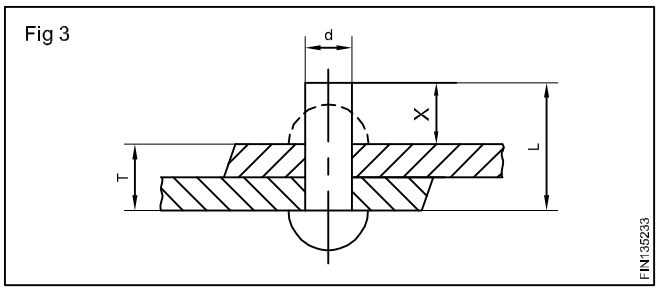
L = T + 1.5D
Length of countersunk head rivets L = T + 0.6 D
L = shank length
T = total thickness of the number of plates used
D = rivet diameter
D_1 = hole diameter

Rivet interference: The length required to form the head in riveting is called rivet interference.

When forming a round head (Fig 3) the interference x is given as

x = d x (1.3, - 1.6)
where x = rivet interference (mm)
d = rivet diameter (mm)

Fig 3



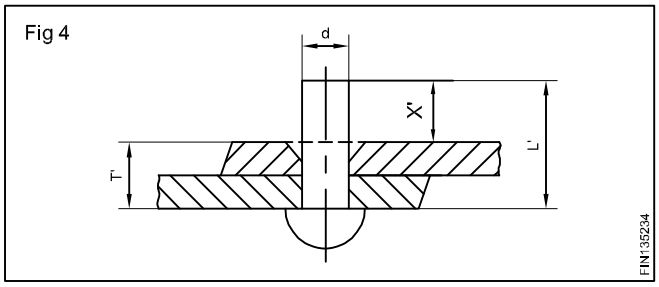
Therefore, the length of the rivet (L mm) to form a round head when the total thickness of the piled plates is T mm will be, as given below.

L = T + d (1.3 ~ 1.6)

When forming a flat head (Fig 4) the length of the rivet (L'mm) will be as given below.

L' = T + d (0.8 ~ 1.2)

Fig 4



When he appropriate values of the rivet diameter and the length for the plate thickness are found out, choose the rivets with the standard size close to the calculated values.

Types of riveted joints

Objectives: At the end of this lesson you shall be able to
- **state the different types of riveted joints**
- **state the features of different types of riveted joints**
- **distinguish between chain riveting and zigzag riveting.**

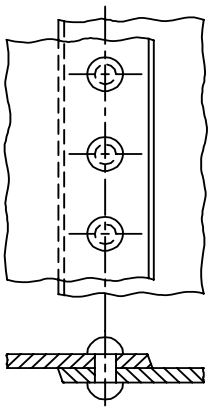
In construction and fabrication work different types of riveted joints are made.

The commonly used joints are:

– single riveted lap joint
– double riveted lap joint
– single strap butt joint
– double strap butt joint

Single riveted lap joint: This is the simplest and most commonly used type of joint. This joint is useful for joining both thick and thin plates. In this, the plates to be joined are overlapped at the ends and single row of rivets is placed in the middle of the lap.(Fig 1)

Fig 1



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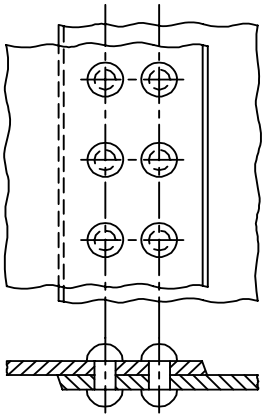
Double riveted lap joint: This type of joint will have two rows of rivets. The overlap is large enough to accommodate two rows of rivets.(Fig 2)

Fig 2



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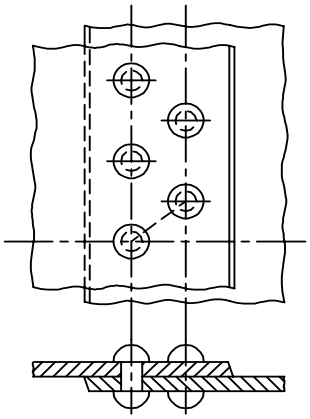
Double riveted (Zigzag) lap joint: This provides a stronger joint than a single lap joint. The rivets are placed either in a square formation or in a triangular formation. The square formation of rivet placement is called CHAIN riveting. The triangular formation of rivet placement is called zigzag riveting.(Fig 3)

Fig 3



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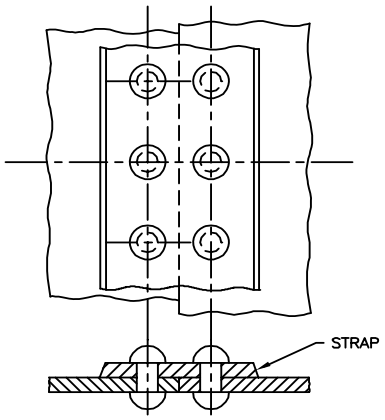
Single strap butt joint: This method is used in situations where the edges of the components are to be joined by riveting.(Fig 4)

Fig 4

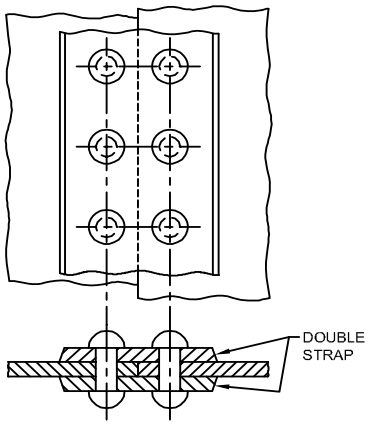


FIN:35244

A separate piece of metal called STRAP is used to hold the edges of the components together.

This joint is also used for joining the edges of components together. This is stronger than the single strap butt joint. This joint has two cover plates placed on either side of the components to be assembled.(Fig 5)

Fig 5



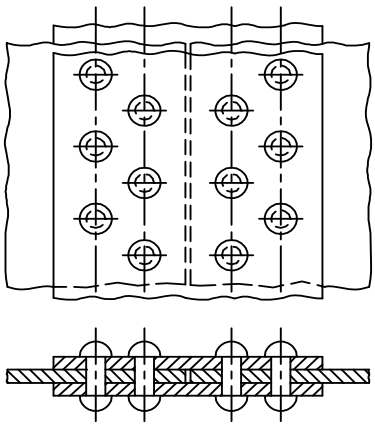
FIN:35245

When single or double straps are used for riveted butt joints, the arrangement of rivets may be:

– Single riveted i.e one row on either side of the butt.

– double or triple riveted with chain or zigzag formation. (Fig 6)

Fig 6



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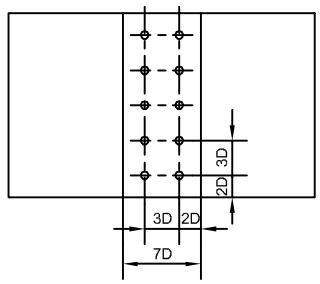
Layout the spacing of rivet holes in chain riveting

Objectives: At the end of this exercise you shall be able to
- **lay out the spacing of rivet holes to make chain riveting**

Fig1 shows the layout of the spacing of rivets holes in chain riveting

In chain riveting, square formation of rivets is formed in placement of rivets.

Fig 1



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Zig Zag Riveting

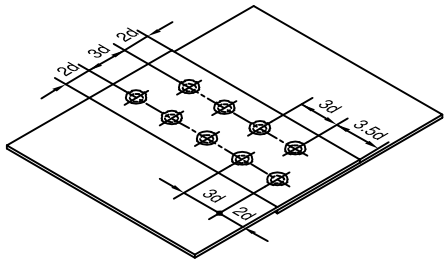
objectives: At the end of this exercise you shall be able to
- **State what is zigzag riveting**
- **draw the layout for the spacing of rivets in zigzag riveting**

Zig zag riveting is one type of layout of rivet spacing in veted joint

Zig zag riveting, triangular formation of rivets is formed in placement of rivets.

Layout of spacing for zigzag riveting is shown in Fig 1.

Fig 1



ZIGZAG RIVETING

FIN135261

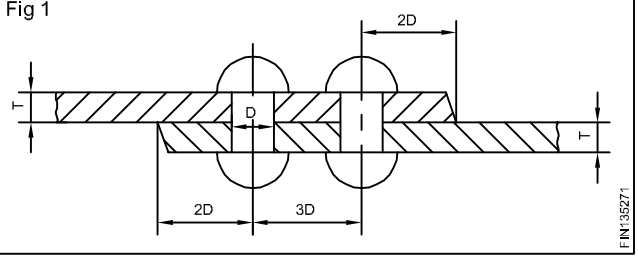
Spacing of rivets in joints

Objectives: At the end of this lesson you shall be able to
- **determine the distance between the rivet and the edge of the joint**
- **state the effect on the joints when the rivets are too close or too far from the edge**
- **determine the pitch of rivets in joints**
- **state the effect of too close and too far a pitch of rivets in joints.**

The spacing of the rivet holes depends upon the job. Given below is a general approach in determining this.

Distance from the edge to the centre of the rivet.(Fig 1)

Fig 1



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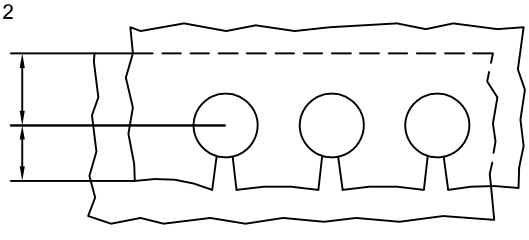
The space or distance from the edge of the metal to the centre of any rivet should be atleast twice the diameter of the rivet.

The purpose of this is to prevent the splitting of the edges. The maximum distance from the edge should not be more than ten times the thickness of the plate.(Fig 2)

Fig 2



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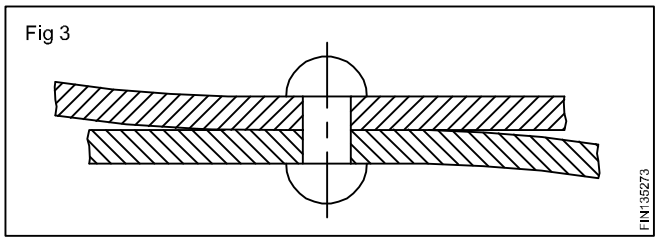
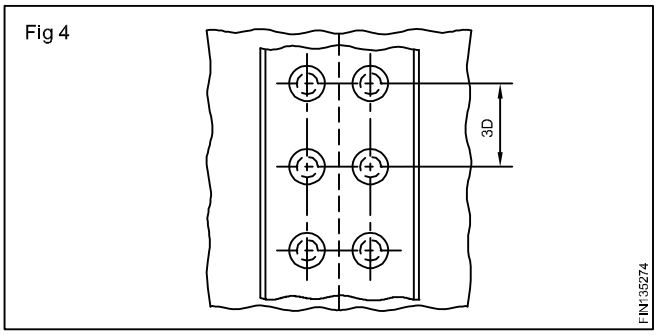
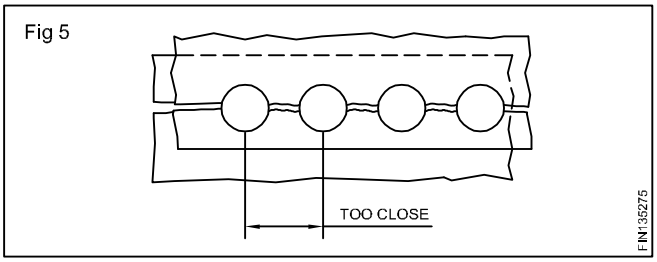
Too much distance from the edge will lead to GAPING. (Fig 3)



Pitch of rivet: The minimum distance between rivets should be three times the diameter of the rivet. (3D) (Fig 4)



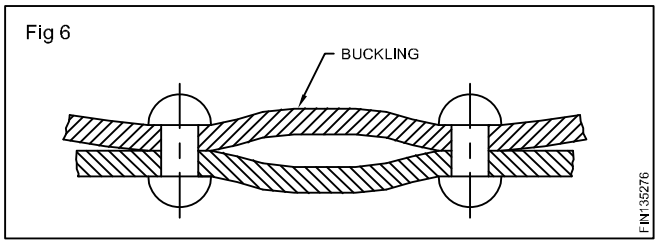
The distance will help to drive the rivets without interference.(Fig 5)



Too closely spaced rivets will tear the metal along the centre line of the rivets.

The maximum distance between the rivets should exceed twenty four times the thickness of the metal.(Fig 6)

Too far a pitch will allow the sheet/plate to buckle between the rivets.

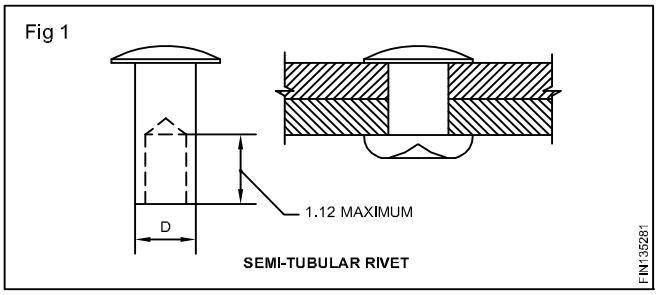


Tubular bifurcated and metal piercing rivets

Objectives: At the end of this lesson you shall be able to
- **state different types of tubular and bifurcated rivets**
- **state the constructional features of them**
- **state the application of them.**

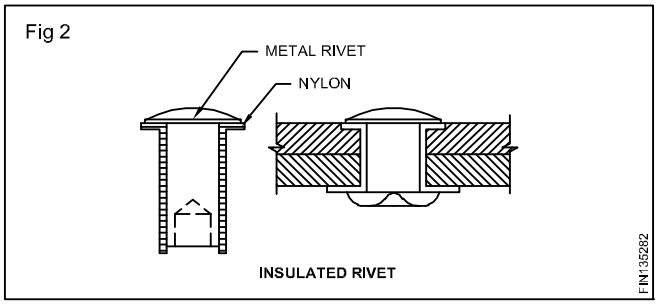
Tubular and bifurcated rivets: These rivets are used in low tension joints or for joining softer materials to sheet metals, as given hereunder.

Semi-Tubular rivets: This rivet has straight hole or tapered hole at the end of the shank. The depth of the hole must not exceed 1.12 time shank diameter as shown in Fig 1. The rivet shank should extend upto the full thickness of the joint, with the hollow portion set to give correct upsetting.

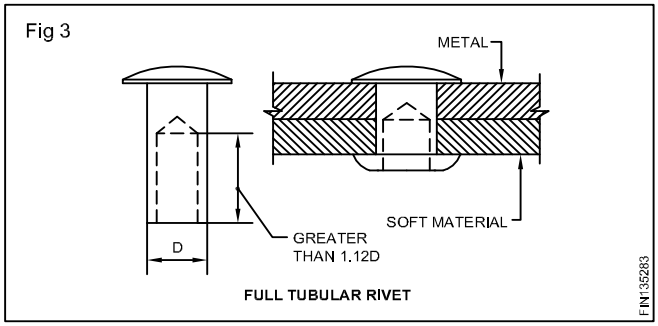


Insulated rivets: This rivet is semi-tubular and under the rivet head, it is covered with thick nylon as shown in Fig 2.

The main application of these rivets are in electrical assemblies, where the rivet needs to be insulated from the workpiece, and also for air tight or water tight joints.

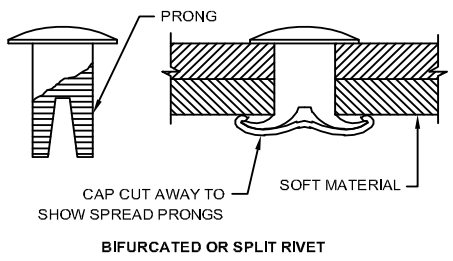


Full Tubular rivets: This rivet has a hole greater than 1.12D and is designed for use, where the rivets is desired to punch the rivet through soft materials as shown in Fig 3.



Bifurcated or Split rivet: The bifurcated or split rivet is machined to produce two prongs at the shank end to pierce soft materials as shown in Fig 4.

Fig 4



BIFURCATED OR SPLIT RIVET

Metal piercing rivets (Fig 5)**:** These rivets pierce their own holes into the sheet metal joints.

These are similar to solid rivets and have good tension and shear characteristics. These are economical as they produce their own holes and are used in mass production applications.

Semi-tubular metal piercing rivets: These rivets are designed to use as punches to penetrate fully or partially on both pieces of the metal.

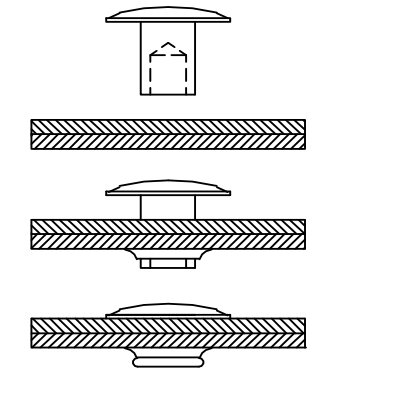
If the rivet fully penetrates the metal, it then completes the joint as shown in Fig . When the rivet partially penetrates the metal, the tail of the rivet forms a sealed joint.

Total sheet metal base thickness upto 2.5 mm can be used for semi-tubular metal piercing rivets.

Metal-piercing solid rivets: In this countersunk solid rivets can be driven into the sheet steel upto 3.2 mm total thickness with out the need of a hole. Penetration by the rivet, counter sinking and clinching the rivet against an upsetting tool, are completed in a single stroke. The counter sunk head produces a flashed hole which improves joint shear strength.

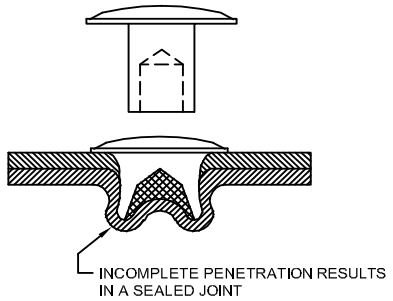
Expansion of the rivet end on the other side of the workpiece, prevents pull out.

Fig 5

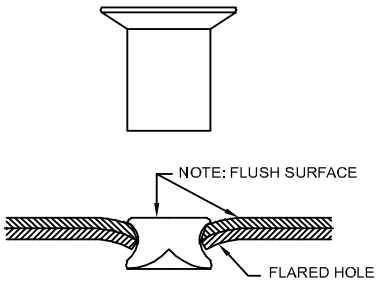


CLINCH WHEN SET TO PENETRATE BOTTOM SHEET

CLINCH WHEN SET TO PENETRATE BOTTOM SHEET



SEMI-TUBULAR MATAL PIERCING PARTIAL PENETRATION



METAL PIERCING SOLID RIVETS

METAL PIERCING RIVETS

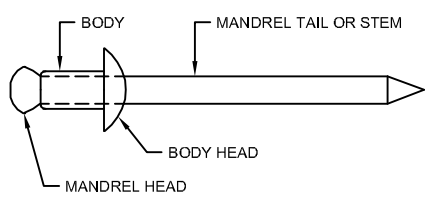
Blind rivet or pop rivet

Objectives: At the end of this lesson you shall be able to
- **state the types of blind rivets, their parts and application**
- **state the blind riveting equipment**
- **state the steps in riveting the blind rivets.**

Blind rivets are designed to allow them to be installed in joints which are accessible from one side only. However, for many reasons including simplicity and good appearance, they are used for joints from both sides are accessible. Prepared holes are required for blind riveting.

The parts of the rivet is shown in the Fig 1. The mandrel portion is used for assembly purposes only and after use, it is either totally or partially discorded. (Fig 2)

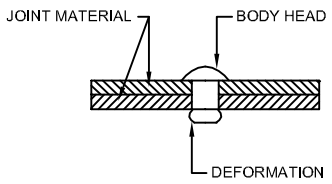
Fig 1



BLIND RIVET

Blind riveting equipment: The equipment used for blind rivets are blind rivet pliers, lazy tongs, lever hand tools,

Fig 2

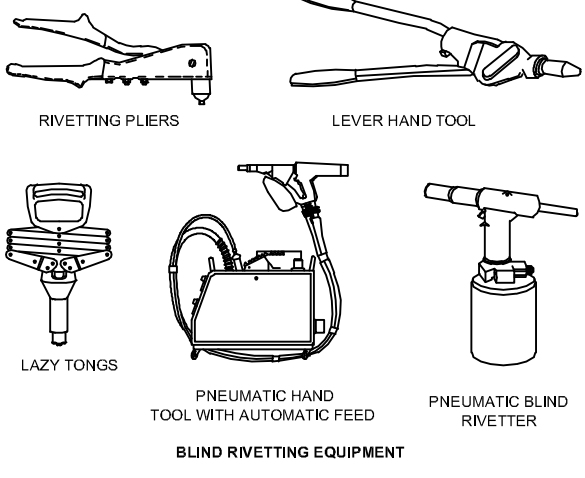


BLIND RIVET SET IN PLACE

FIN135292

pneumatic and hydraulic magazine feed and semi-automatic fasteners as shown in Fig 3.

Fig 3



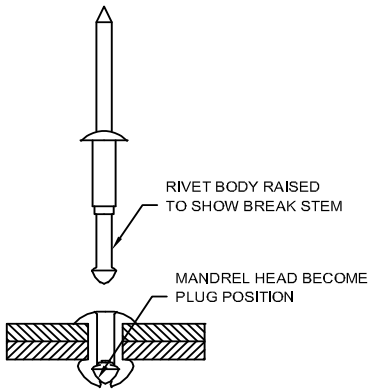
BLIND RIVETTING EQUIPMENT

FIN135293

Types of Blind or Pop rivets: In setting a blind rivet, the body of the rivet is inserted into a hole and the mandrel is pulled deforming the tail which pulls and fixes the joint together. Blind rivets are available in many types and systems. Some of these are given here-under.

Plugged break stem: After the rivet tail has been deformed by the action of the mandrel, the mandrel stem breaks, leaving the head behind forming a plug as shown in Fig 4.

Fig 4



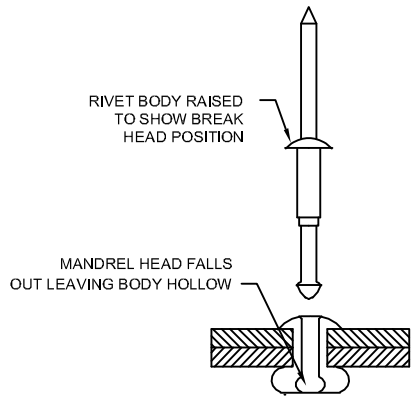
PLUGGED BREAK STEM

FIN135294

Open break stem: It is similar to the break stem, but the head breaks off and falls out after deforming the tail, leaving the hollow body open. (Fig 5)

Sealed: The sealed type rivet is hollow cored with a closed blind end and is used where a water or pressure tight rivet is essential. (Fig 6)

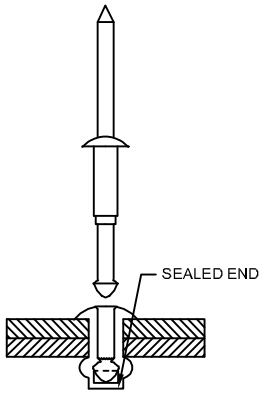
Fig 5



OPEN BREAK STEM

FIN135295

Fig 6

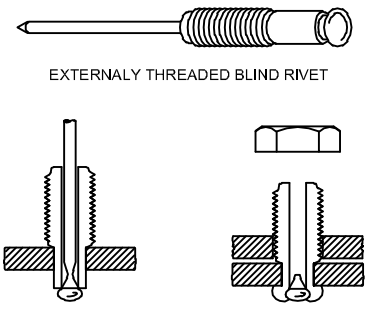


SEALED

FIN135296

Externally threaded blind rivets: This rivet is a conventional pull mandrel blind rivet. When the rivet is set, the head section protrudes providing a metric thread stud into which a nut can be fastened. (Fig 7)

Fig 7



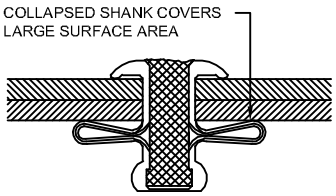
SETTING THE EXTERNALY THREADED BLIND RIVET

FIN135297

Collapsible shank: The tail or shank of this rivet is designed to deform into three segments. (Fig 8) It spreads the clamp up load over a wide area, making it suitable for assemblies having bigger size hole and also to prevent pull out in soft materials.

Flush break high strength: This blind rivet in 3 to 6 mm diameters has a mandrel with specially designed head that breaks off flush with the top of the rivet. (Fig 9)

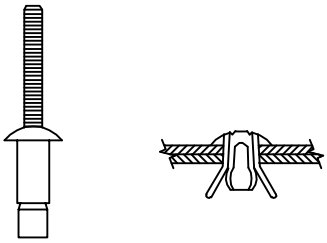
Fig 8



BLIND RIVET TYPES

FIN135298

Fig 9

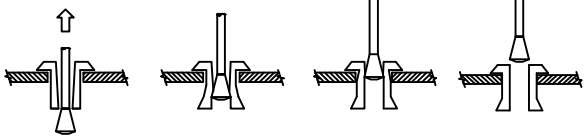


FLUSH BREAK HIGH STRENGTH

FIN135299

Repetition blind riveting systems: Rivet is loaded onto a mandrel which is placed into a pneumatic setting tool with a rivet in the ready position. This rivet is inserted into a preformed hole, the tool trigger is actuated, drawing the mandrel through the rivet, expanding the rivet tail. Sequence of rivet setting is shown in Fig 10.

Fig 10



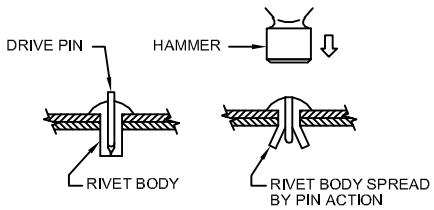
SEQUENCE OF RIVET SETTING REPETITION BLIND RIVETTING SYSTEMS

BLIND RIVET TYPES

FIN13529A

Drive pin rivets: Drive pin rivets consist of a hollow body and a pin. In the manufactured condition itself, the pin projects from the rivet head. A hammer blow forces the rivet into the prepared hole, the pin expands the rivet and spreads pre-slotted shank prongs. (Fig 11)

Fig 11



DRIVE PIN RIVETS

FIN13529B

Riveting blind rivet

Riveting steps

1 Select a rivet for the correct size of dia and length.

2 Drill a hole to the recommended diameter.

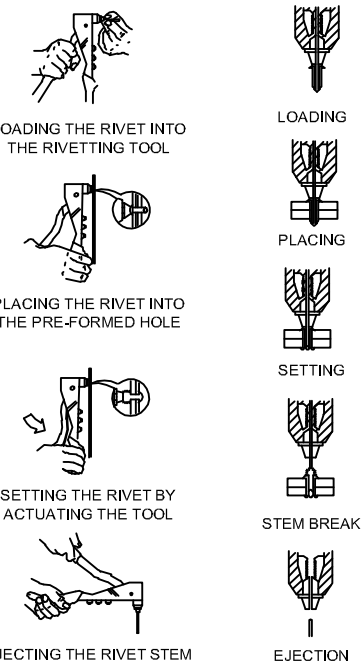
3 Open the riveting tool and insert the rivet stem into the tool nozzle.

4 Place the rivet body into the preformed hole.

5 Squeeze the rivet tool handles together to set the rivet, at the correct point of tension, the rivet stem will break.

6 When the rivet stem has broken, remove the tool from the job. Allow the tool to open fully to eject the spent rivet stem. (Fig 12)

Fig 12



SETTING A STANDARD BLIND RIVET

FIN13529C

Lazy tong

Objectives: At the end of this lesson you shall be able to
- **state what is a lazy tong**
- **state parts and mechanism of a lazy tong**
- **state the operating instructions.**

Lazy tong is a hand operated tool, used for setting 1/8", 5/32" and 3/16" diameter standard open type blind rivets. It is important to use the correct nosepiece for the diameter of the rivet to be placed, to ensure the best performance of the tool. The parts list is shown in the figure and all parts are fully interchangeable.

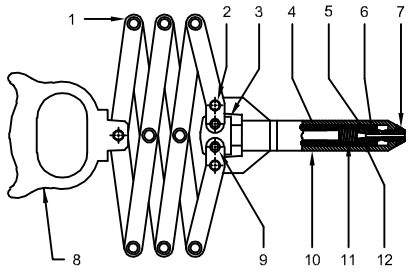
Description of mechanism: The mandrel gripping mechanism consists of a set of jaws (6) fitted into the jaw case (5) and screwed on to the power coupling assembly. The jaws are kept in the forward position by the jaw pusher (12) AND JAW PUSHER SPRING (11).

The lazy tong mechanism is connected to the power coupling in such a way that the operation of the handle (8) which draws the jaws, is gripping the rivet mandrel, thus setting the rivet.

Operating instructions: Check that the suitable nosepiece is fitted to the tool and firmly screwed into the threads.

\When the mandrel breaks, the rivet is set.

Fig 1



PARTS LIST OF LAZY TONG

NO.	DESCRIPTION	QTY.
1	LINKAGES	1 SET
2	LOCK NUT	2
3	YOKE	1
4	POWER COUPLING	1
5	JAW CASE	1
6	JAWS	1 SET
7	NOSE PIECE	1
8	HANDLE	1
9	FULCRUM PINS	2
10	BODY	1
11	JAW PUSHER SPRING	1
12	JAW PUSHER	1

FIN:352A1

Hand-riveting tools

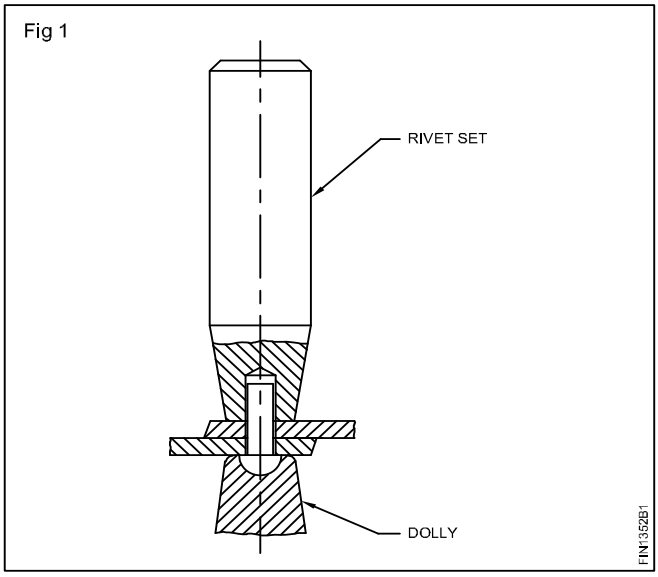
Objectives: At the end of this exercise you shall be able to
- **name the different hand-riveting tools**
- **state the uses of different hand -riveting tools**

Rivet set

It is used for bringing the sheet metal closely together after inserting the rivet in the hole

This is required while riveting thin plates or sheet with small rivets (Fig 1)

Fig 1



FIN:352B1

Dolly

It is used to support the head of the rivet which is already formed and also to prevent damage to the shape of the rivet head (Fig 1)

Rivet snap

It is used to form the final shape of the rivet during riveting. Rivet snaps are available to match the different shapes of rivet heads (Fig 2)

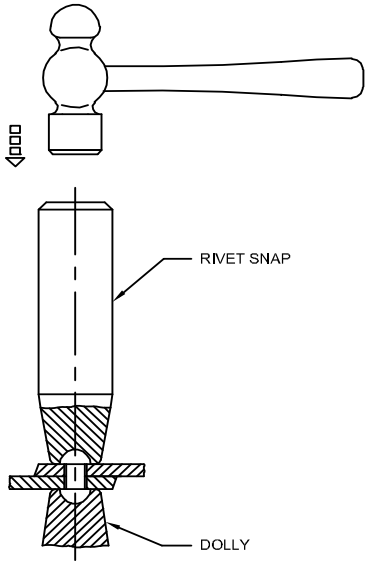
Combined rivet set: This is a tool which can be used for setting and forming the head (Fig 3)

Hand riveter: This has a lever mechanism which exerts pressure between the jaws when the handle is pressed.

This is useful for riveting copper or aluminium rivets. Interchangeable anvils can be provided.(Fig 4)

Pop riveter: This is used for riveting pop rivets by hand. The trigger mechanism squeezes the rivet and separates the mandrel of the rivet. In this method as the mandrel is being separated from the rivet, the head is formed on the other end (Fig 5)

Fig 2



FIN1352B2

Fig 3

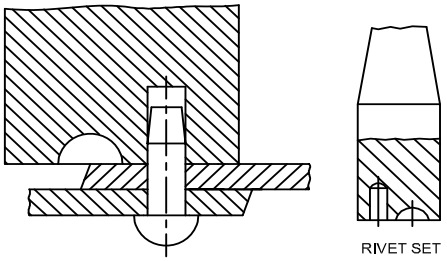


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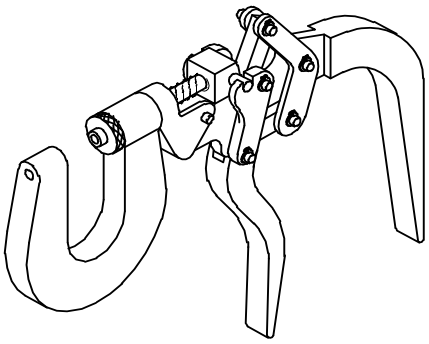
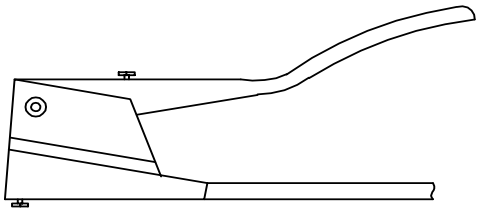
Fig 4



SM11024A

Fig 5



FIN1352B5

Drift

It is used to align the holes to be riveted. (Fig 6)

Caulking tool

It is used for closing down the edges of the plates and heads of the rivets to form a metal-to-metal joint (Fig 7)

Fig 6

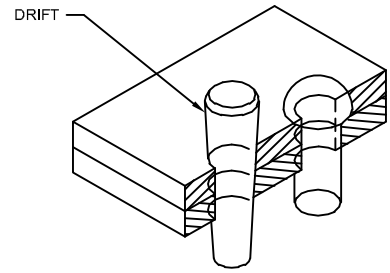


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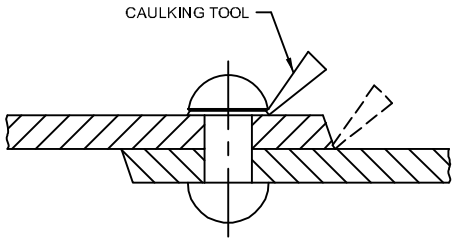
Fig 7



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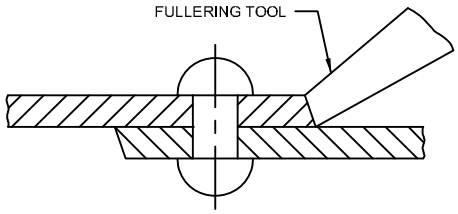
Fullering tool

It is used for pressing the surface of the edge of the plate (Fig 8) Fullering helps to make fluid-tight joints.

Fig 8

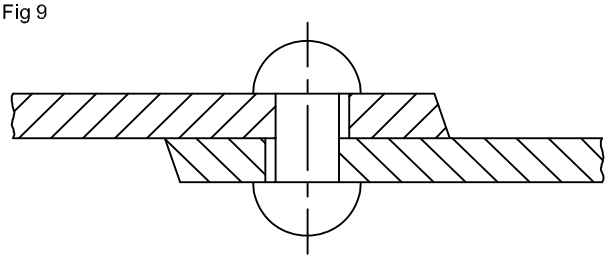


FIN1352B8

Reasons for faulty rivetting

The holes on the plate are not in line (Fig 9)

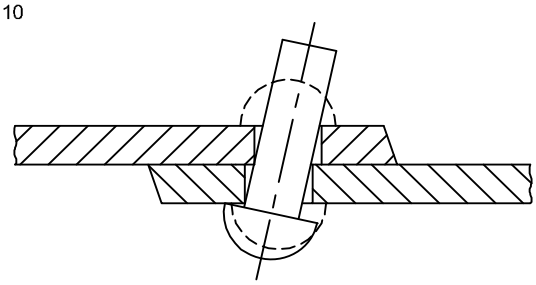
Fig 9



FIN1352B9

The shank or body of the rivet is not perpendicular to the plate before riveting (Fig 10)

Fig 10



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Too much or too little allowance has been given. (Fig 11 and 12)

Fig 11

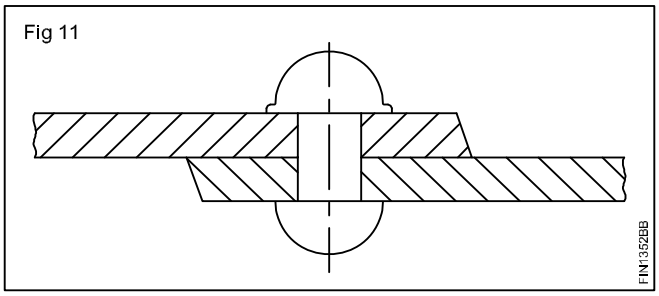
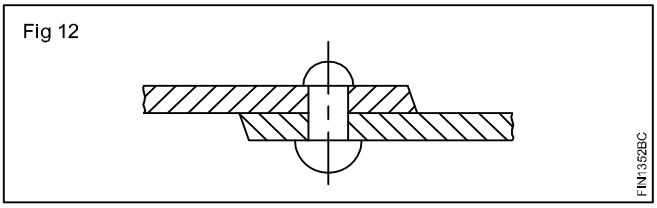
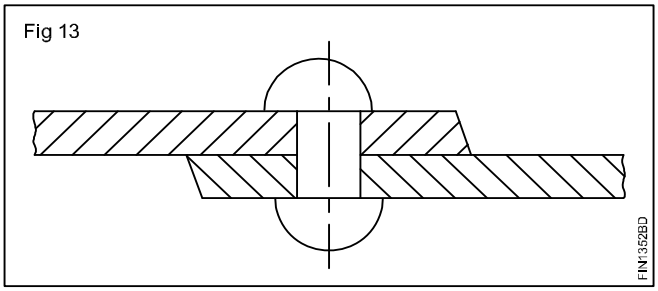


Fig 12



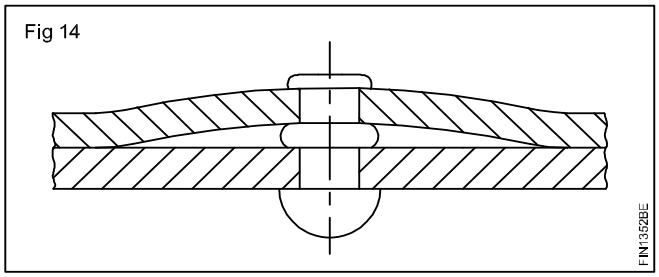
Rivet head is not centered with the shank or body of the rivet (Fig 13)

Fig 13



Improper joining of plates.(Fig 14) plates are not brought closely together using rivet set.

Fig 14



Burrs between plates and in drilled holes.(Fig 15 and 16)

Fig 15

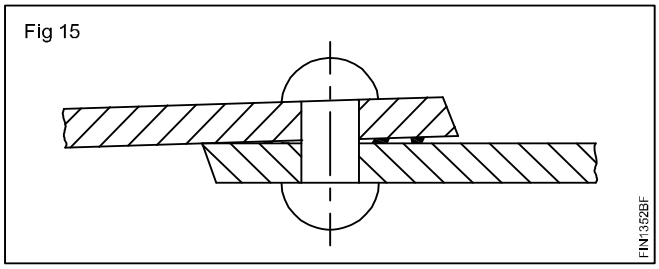
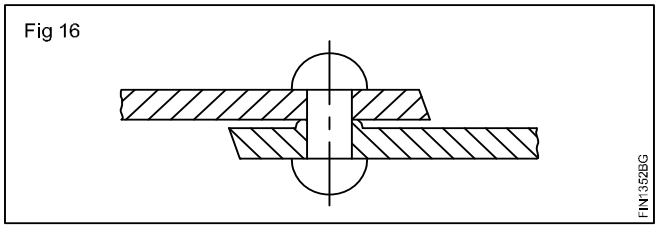


Fig 16

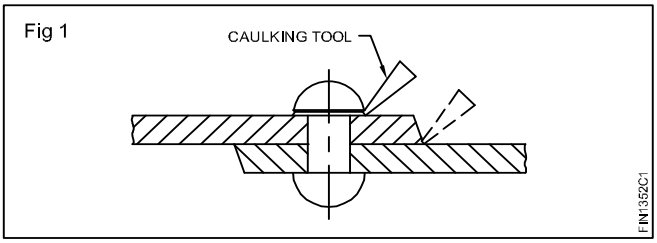


Caulking and fullering

Objectives: At the end of this lesson you shall be able to
- **state the purpose of caulking and fullering**
- **distinguish between caulking and fullering processes.**

Caulking: Caulking is an operation of closing down the edges of the plates and heads of the rivets to form a metal-to-metal joint.(Fig 1)

Fig 1

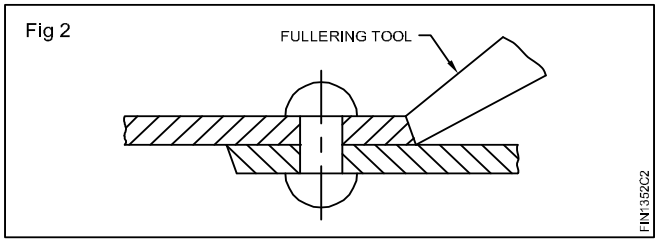


The edge of the rivet head is tightly pressed and expanded on the plate by a caulking tool which looks like a fattened cold chisel.

Fullering: Fullering is an operation of pressing the whole surface of the edge of the plate. It is done by a fullering tool.(Fig 2)

When the caulking tool is about as thick as the plate, it is called a fullering tool.

Fig 2



The whole surface of the edge of the first plate is tightly pressed on the second plate.

A better fluid-tight joint is achieved by fullering.

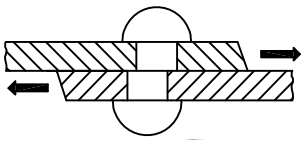
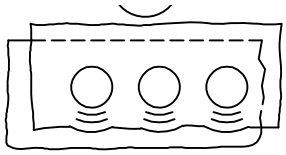
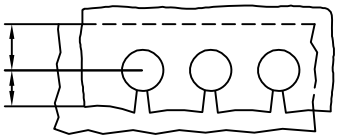
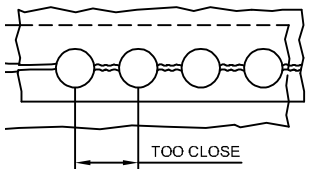
Caulking is done on the edges of the plates as well as on the edges of the rivet heads. But fullering is done on the edges of the plate only. To facilitate caulking and fullering on the plates, the edges of the plates are bevelled about 80^0 to 85^0.

The strength of riveted joints: A riveted joint is only as strong as its weakest part and it must be borne in mind that it may fail in one of the following four ways.

- Shearing of the rivet
- Crushing of the metal
- Spliting of the metal
- Rupture or tearing of the plate

These four undesirable effects are illustrated in the table below.

Table

Riveted joints	Effects	Causes	Prevention
	Shearing of the rivet	Diameter of the rivet too smal compared with the thickness of the plate. The diameter of the rivet must be greater than the thickness of the plate, in which it is to be riveted. Strength of trivet material is less when compared to the materials of the plates.	Select the correct diameter rivet to suit thickness of the plate. Select a suitable material visit.
	Crussing of the rivet	Diameter of the rivet too large compared with the thickness of the plate. The rivets when driven tend to bulge and cursh the metal in front of them.	Select the correct diameter rivet for the thickness of the metal plate.
	Splitting of the metal	Rivet holes punched or drilled too near the edge of the plate. Metal is likely to fail by splitting in front of the rivets.	Drill or punch the rivet at the correct distance from the edge and use the correct lap allowance for the diameter of the rivet.
	Tearing of the plate	Plates weakened by rivet holes being too close together. Plates tend to rupture along the centre line of the rivets	Punch or drill rivet holes at the correct spacing or or pitch. In addition remove all burrs from the holes before final assembly.