

UNIT: 3

Sheet Metal work

STRUCTURE

Introduction
Metals used in Sheet Metal Work
Tools and Equipment
Sheet Metal Operations

INTRODUCTION:

The metal flange having less than 2mm thick is called sheet metal. Sheet metal work deals with the production of components in a wide variety of shapes and sizes from sheet metal with the aid of hand tools or machines.

METALS USED IN SHEET METAL WORK:

1. Galvanized Iron:

It is a sheet of soft steel which is coated with zinc. Zinc resists corrosion and improves the appearance of metal. It is used for making pans, buckets, duct, gutters, tanks and boxes.

2. Black Iron:

It is an uncoated sheet of metal. It corrodes easily. The parts which are made are coated with paint.

3. Tin plate:

Tin plate is a iron or steel coated with pure tin. It is used for food containers, cans and pans.

4. Stainless Steel:

It is an alloy steel which has corrosion resistance. This steel is commonly known as 18-8 stainless steel. It contains 18% chromium and 8% nickel. It is used for making food containers, dairy equipment, surgical instruments, chemical plants, kitchen wares etc.

5. Copper:

It has reddish color and possesses good malleability ductility and resistant to atmospheric corrosion. It is used for making water pipes, roofing, cutters and other parts of building.

6. Aluminum:

Aluminum sheets are the alloy of copper, silicon, magnesium and iron. It has resistance to corrosion. It is used in construction of aero plane, refrigerators, light fixture, windows and ventilators.

Tools and Equipment:

Sheet metal hand tools:

1. Steel rule:

It is used for measuring and lay outting small works with accuracy up to 0.5mm.



Fig. 3.1 Steel Rule

2. Vernier caliper:

It is used for measuring dimensions upto 0.05mm.

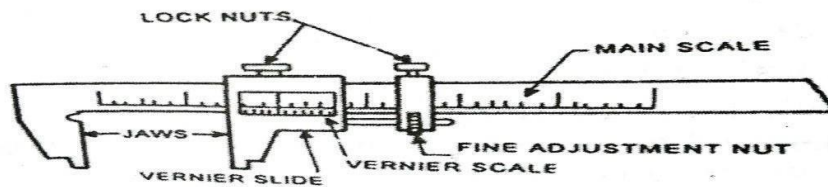


Fig. 3.2 Vernier Caliper

3. Micrometer:

It is used to measure the thickness of sheet upto 0.01mm.

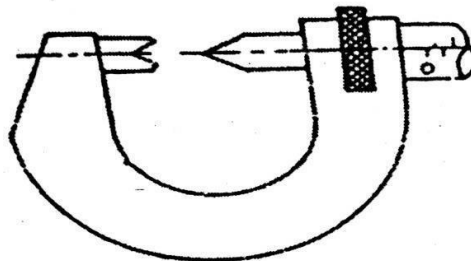


Fig. 3.3 Micrometer

4. Sheet metal gauge:

This is used to measure the thickness of sheet.

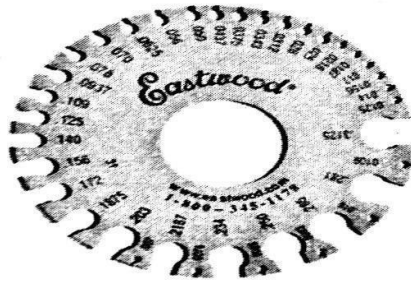


Fig. 3.4 Sheet metal gauge

5. Straightedge:

It is a steel bar has one long edge is beveled and comes in variety of lengths. It is used for drawing long straight lines.

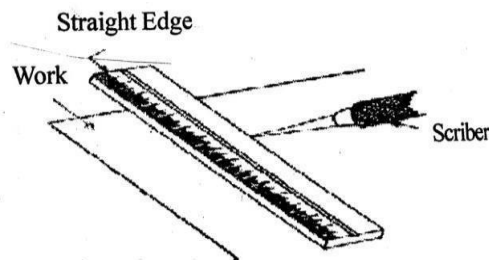


Fig. 3.5 Straight edge

6. Scriber:

It is a steel wire to mark layout lines on the sheet metal.

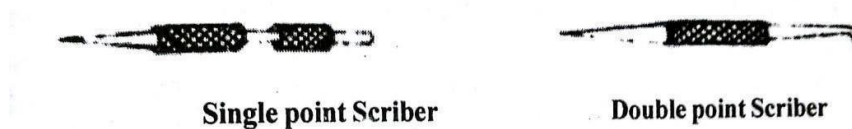


Fig. 3.6 Types of Scriber

7. Divider:

Dividers are used to draw circles or arcs on sheet metal and to divide the lines into two equal parts.

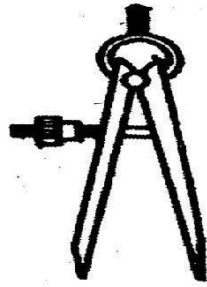


Fig 3.7 Divider

8. Trammel point:

It is used to draw large circles and arcs.

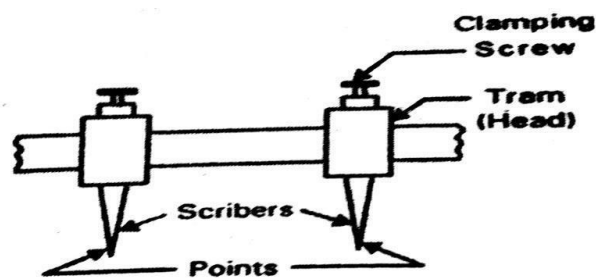


Fig 3.8 Trammel point

9. Chisel:

Chisel is used to cut sheets, rivets, bolts and for chipping operation.

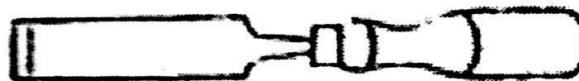


Fig 3.9 Chisel

10. Punches:

Punches are used for making small indentation on the work piece. Punch is of two types 1.Prick punch and 2.Center punch.

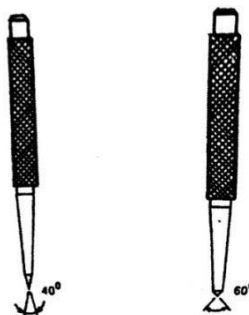


Fig 3.10 Punches

Hammers:

Hammers are used for forming shapes by hallowing, stretching or throwing off. The types of hammers are

- ❖ Ball pin Hammer: It is used for general purpose.
- ❖ Rivet Hammer: It is used for spreading rivets.
- ❖ Setting hammer: Flat facer is used for flattening seam without damage to the sheet metal.
- ❖ Rising Hammer: it is used for denting the metal down to shape.
- ❖ Mallets: Mallets are used for make light blows on the sheet. These are made with fiber, plastic, wood or rubber.

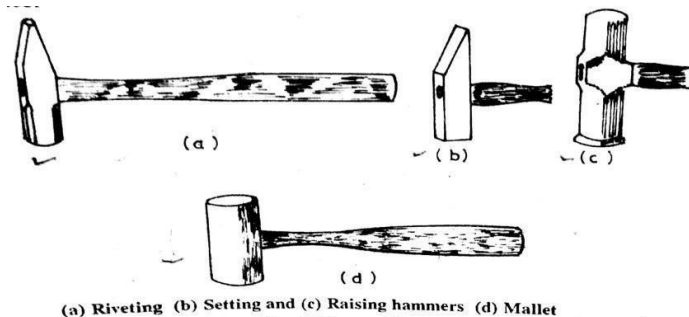


Fig 3.11 Types of Hammer

1. Snips or shears:

These are heavy scissors used for making straight or circular cuts. The common types of snips are straight snips which are used for straight cuts and bend snips are used for make a curved cuts.

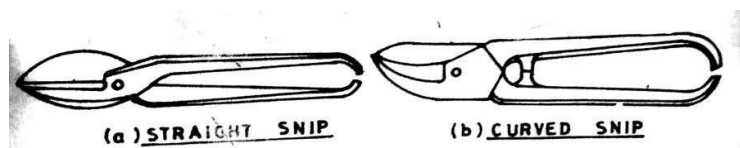


Fig 3.12 Types of snips

2. Pliers:

Pliers are used to forming and holding the work. Round nose pliers are used for holding and forming into various shapes.

3. Stakes:

These are used for bending, seeming, farming using hammer or a mallet. They are work supporting tools while working. The double seeming steamers are used to make a double seam. The brake horn stake is used for riveting and forming long surfaces, bending straight edges and making corners. The bevel edged stake is used for making straight and sharp bends.

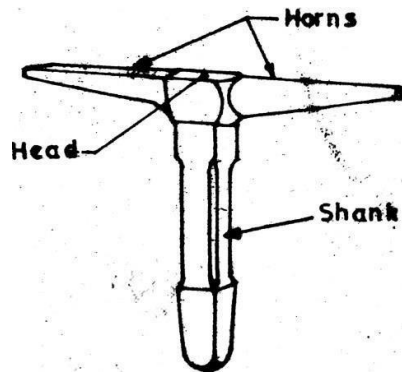


Fig 3.13 Stakes

4. Groves:

These are used for grooving and flattening a seam.

5. Rivet set:

Rivet set has a deep hole in the bottom to draw a rivet through metal and a cup shaped hole to form the finished head of a rivet.

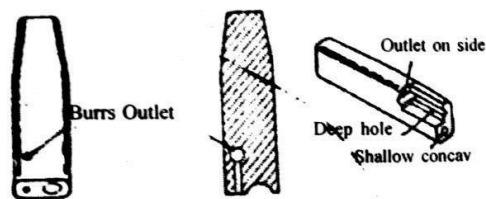


Fig 3.14 Rivet set

6. Soldering Iron:

It is used to join two pieces of metal by soft soldering by using an alloy of tin and lead. Soft solder is transferred to join by means of soldering iron.

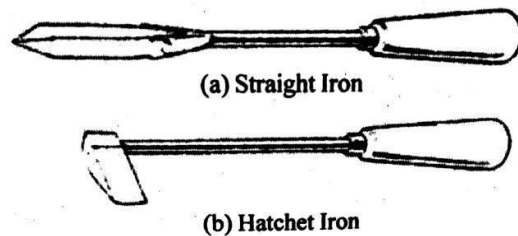


Fig 3.15 Soldering Iron

Sheet Metal Operations:

The various operations are required to produce an object from sheet metal.

These operations may be classified as:

1. **Shearing**
2. **Bending**
3. **Drawing and**
4. **Squeezing**

1. Shearing:

It is the process of cutting across a sheet or strip. The various shearing operations include.

- a. **Cutting off:** Process of severing a piece from a strip by cutting along a single line.
- b. **Parting:** Separating a piece from a strip by removing the scrap. The width of cut is equal to the thickness of scrap removed.
- c. **Blanking:** Operation of cutting out desired shape from the strip by a single blow of the punch.
- d. **Punching & piercing:** Process of making a desired hole by using a punch and die. The term punching is restricted to circular holes.
- e. **Notching:** process of cutting out the edges of the strip to obtain the desired outer counter of the work piece. Various types of notches for folding a sheet metal are shown.
- f. **Slitting:** Process of cutting a strip in a line along its length.
- g. **Lancing:** Cutting operation in which hole is partly cut and bending down the cut portion.
- h. **Nibbling:** Process of cutting any counter from sheet metal; a small punch is used for generating the required profile. It involves removing the metal in small increments.
- i. **Trimming:** Process of finishing the edges of a part by removing the flash or excess metal around it.

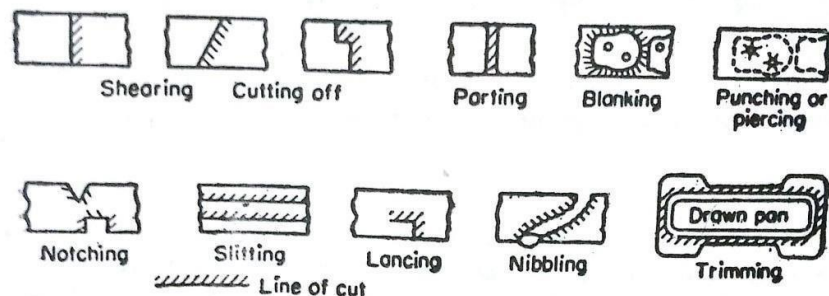


Fig 3.16 Types of shearing operations

2. Bending:

Bending is the folding operations by using suitable tools. The common forms of bending sheet metal are single bend, double bend, straight flange, embossing, bending and folding edges and seams. A number of methods can be

used to bend or fold sheets.

a. Folding Edges:

The edges of the sheet metal objects must be formed. This ensures safe edge with finished appearance. In addition, it provides additional strength. The various forms of folding edges are shown:

Hem is a folding edge on the sheet metal. It is intended to increase the strength and to make a smooth finished edge. The double hem provides much greater strength than the single iron.

b. Wired Edge:

Provides a clean and safe edge. It has greater strength and double hem. The technique of forming wired edge is known as wiring and this consists of folding a piece of sheet metal around a wire of given diameter.

c. Seams:

Seaming is the process of joining the edges of sheet metal, and the sections where pieces of sheet metal joined is called a seam. The various types of seams are shown:

The lap seam is a simple type of seam and it consists of lapping the edge of one sheet over the other. The joint is made permanent either by soldering or riveting.

The Grooved seam is one of the most common types of seams used in sheet-metal work. It consists of hooking two folded edge and locking them together with a hand Grover. A single seam and a double seam are used to join a bottom to a vertical body such as containers. The folding of edges for single and double seams is shown:

Types of notches: Notching is the process of making a slit or penning at the edges of sheet-metal. This prevents over lapping of sheet where the corners come together. The size, location and type of notches depend on the shape of the object.

d. Flanging and Burring:

Flanging is the operation of producing edges having various widths and angles on flat or curved sheets. Flanging on cylindrical article is difficult than straight flanging.

The process of making a narrow flange is known as “Burring” and is performed on burring machine.

e. Rising:

Rising is the process of making depression on flat surface so as to form curved shapes. It is shaped by hammering on a suitable raising block.

f. Hallowing:

It is process of deformation of sheet-metal into a particular shape. It involves the stretching of the metal, and is usually done on a hollow wooden block.

g. Planishing:

It is a finishing process applied to sheet-metal. It is intended to bring the final shape with an improved surface, and imparts some degree of hardness to the metal.

3. Drawing:

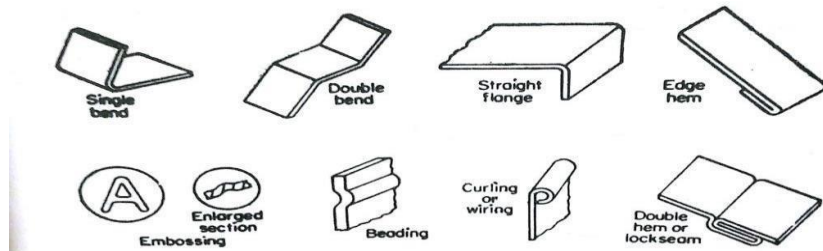


Fig 3.17 Different forms of Bending

Drawing the process of producing the hollow shapes such as cups and dishes from a flat sheet metal. Drawing processes can be classified into two types:

1. Deep drawing 2. Shallow or Box drawing.

In deep drawing the height of the component is greater than the diameter or width. In shallow or box drawing the height of the component is less than the diameter or width.

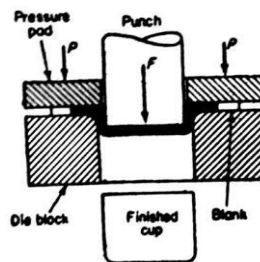


Fig 3.18 Drawing

4. Squeezing:

Squeezing operation involves the severe cold deformation. It requires a greater amount of pressure to deform metal, at cold state, within the confined space of die and punch to attain desired shape. Sizing, coining, hobbing, ironing, riveting etc. are examples of squeezing operations.

- a. **Sizing:** It is a squeezing operation employed to attain close tolerances and smooth surface finish. In this operation the metal need not confined in the cavity, and only contact between work piece and the die occurs where the metal required to flow.
- b. **Coining:** Coining is squeezing operation in which the metal flows into the cavity between the punch and i.e. It is employed for making coins, medals and similar articles.
- c. **Hobbing:** It is a process of producing cavities of desired form in a blank of soft material. The process consists of forcing hardened steel hub into the soft metal. During the process the blank is confined in a steel retainer to prevent lateral flow of metal.

- d. **Ironing:** It is a process of reducing the wall thickness of the cup by using punch and die.
- e. **Riveting:** it is a process of cold heading both the ends of slug and is used to fasten two pieces together.

SHEET METAL JOINTS:

1. Hem and Seam Joints:

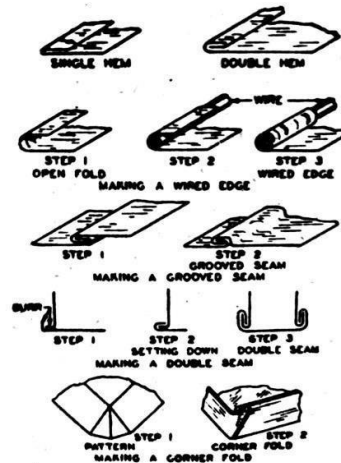


Fig 3.19 Hems and seams

- a. **Hem Joint:** Hem is an edge or boarder made by folding.
 - Single Hem: it is made by single folding of the edge of sheet metal.
 - Double Hem: it is made by folding the edge over twice to make it smooth.
 - Wired edge hem: the holding of a piece of sheet metal around a wire of given diameter.
- b. **Seam joint:** it is a joint formed by two edges of sheet metal.
 - Lap seam: it is a simple type of seam which consists of lapping the edge of one sheet over the other and the joint is made by soldering or riveting.
 - Grooved seam: it is made by hooking two single hems together.
 - Single seam: it is used to join a bottom to vertical bodies of various shapes.
 - Double seam: its formed edges bent upwards against the body.
 - Flanged seam: it is used to join the bottom of a container to its body.
 - Dovetail seam: it is used to join one pipe to another pipe or a sheet to pipe.

Fastening Methods:

The following fastening methods are widely adapted in sheet metal work.

A) Riveting:

It is permanent fastening method by using rivets. Each rivet consists of head, shank and tail and are made of wrought iron, mild steel, aluminum, copper and brass. It is customary to use rivets of the same metal as the parts that are being joined. Riveting with a hammer and rivet set is shown. The required holes must be either punched or drilled before riveting.

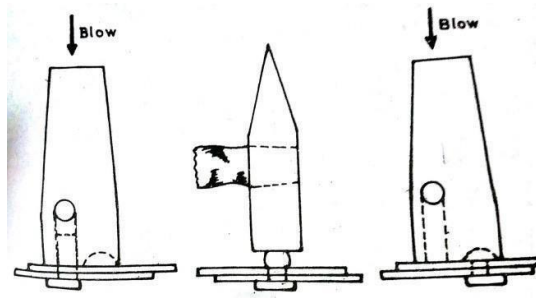


Fig 3.20 Types of Rivets

B) Soldering:

Soldering is the process of joining two or more pieces of metal by means of an alloy. This alloy is called solder and is composed of lead and tin. The melting point of solder is less than the metal being joined. For soldering the base metal is heated by soldering iron which also melts solder and flux. The flux is used to dissolve the oxide film on the surface, and also to prevent any further oxidation during soldering. The molten solder fills the space between mating surfaces, and as it solidifies forms a bond with the surfaces of the joint.

C) Brazing:

Brazing is similar to soldering, but it gives much stronger joint. In general, silver alloys are used as filler material for brazing. This filler material is called “spelter” and its melting point is higher than solder, but lower than the metals being joined.

In any brazing operation the two metal pieces to be joined must be cleaned and are properly fitted together with appropriate clearance for the filler material. Flux is applied on the joint and heated to a temperature just above the melting point of the spelter. The liquid spelter is disturbed between the surfaces by capillary action. After solidification it adheres to surfaces and forms a strong joining.

D) Spot Welding:

Welding is a process of joining metal pieces by application of heat with or without pressure. The spot welding is widely used for joining the sheet metals by application of heat and pressure.

In spot welding the sheets to be joined together are held between two electrodes. A low voltage current of high amperage is passed through electrodes causing local heating and at welding temperature the pressure between the electrodes squeezes the metal together to form a joint.

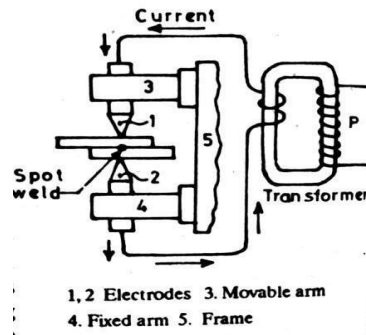


Fig 3.21 Spot Welding

SHORT ANSWER QUESTIONS

1. Write the names of sheet metal hand tools.
2. Write the use of Trammel point in sheet metal work.
3. Write the types of hammers used in sheet metal work.
4. Draw and explain the stake used in sheet metal work.
5. Write the types of Hem and seam joints in sheet metal work.

LONG ANSWER QUESTIONS

1. Write about any three sheet metal operations.
2. Explain metals used in sheet metal work.
3. Explain any three fastening methods used in sheet metalwork.