

SHEET METAL WORK

1. INTRODUCTION

Sheet metal work has its own significance in the engineering work. Many products, which fulfill the household needs, decoration work and various engineering articles, are produced from sheet metals. Common examples of sheet metal work are hoopers, canisters, guards, covers, pipes, hoods, funnels, bends, boxes etc. Such articles are found less expensive, lighter in weight and in some cases sheet metal products replace the use of castings or forgings.

2. METALS USED IN SHEET METAL WORK:

A metal plate of thickness less than 4 mm is considered as sheet. The size of the sheet is specified by its length, width and thickness in mm. In British system, the thickness of sheet is specified by a number called Standard Wire Gauge (SWG). The commonly used gauge numbers and the equivalent thickness in mm are given below

SWG (No.)	16	17	18	19	20	22	24	27	30
Thickness (mm)	1.62	1.42	1.22	1.02	0.91	0.71	0.56	0.42	0.37

The following metals are generally used in sheet metal work:

- i. Black Iron Sheet**
It is the cheapest among all. It has a bluish-black appearance and is uncoated sheet. Being uncoated, it corrodes rapidly. It is prepared by rolling to the desired thickness, then annealed by placing in a furnace and then set aside to cool gradually. The use of this metal is limited to articles that are to be painted or enameled such as stovepipes, tanks, pans etc.
- ii. Galvanized Iron**
It is soft steel coated with molten zinc. This coating resists rust, improves appearance, improves solderability, and improves water resistance. It is popularly known as G.I. sheets. Articles such as pans, buckets, furnaces, cabinet etc. are made from GI sheets.
- iii. Stainless Steel**
It is an alloy of steel with nickel, chromium and traces of other metals. It has good corrosive resistance. The cost of stainless steel is very high but tougher than GI sheets. It is used in kitchenware, food handling equipment, chemical plants etc.
- iv. Copper**
It is a reddish colored metal and is extremely malleable and ductile. Copper sheets have good corrosion resistance as well as good appearance but costs are high as compared to GI and stainless steel. Because of high thermal conductivity, it is used for the radiator of automobiles, domestic heating appliances etc.
- v. Aluminium**
Aluminium cannot be used in its pure form, but is used in alloy form. Common additions are copper, silicon, manganese and iron. It has many qualities like high ratio of strength to weight, corrosion resistant qualities, and ease in fabrication and whitish in color. It is used in manufacturing of a number of products such as refrigerator trays, household appliances, lighting fixtures, window work, construction of airplanes and in many electrical and transportation industries.
- vi. Tin Plates**
It is an iron sheet coated with the tin to protect it against rust. This metal has a very bright silvery appearance and is used principally in making food containers, cans and pans.
- vii. Lead**
It is a very soft, malleable, low melting point and possesses high resistance to acid corrosion. It is having low mechanical strength so it is used to provide lining to the highly corrosive acid tanks. It is also used in radiation shielding.

3. HAND TOOLS:

For measuring, marking cutting and forming, various types of hand tools are used in sheet metal work. A list of them is given below:

- I. Measuring tools
- II. Marking tools
- III. Cutting tools
- IV. Forming tools
- V. Joining tools

I. MEASURING TOOLS

The following types of tools are commonly used in sheet metal shops to measure the dimensions of work pieces:

1. Steel rule
2. Vernier caliper
3. Micrometer
4. Sheet Metal gauge

The above tools are already explained in the fitting section.

SHEET METAL GAUGE

It is a disc shaped piece of metal, having a number of slots on the outside edge as shown in figure. The slots are of various widths and each corresponds to a certain standard wire gauge (SWG) number. The gauge is placed over the edge of the sheet to be measured and a slot is found that will slip over the metal with a light fit pressure. Standard tables are referred to for

conversion of SWG numbers to mm sizes.

II. MARKING TOOLS:

1. Scriber: It is used to scribe or mark line on a metal surface for a variety of purposes. It is a metalworker's pencil

2. Trammel: These are used for drawing large circles and arcs that are beyond the limit of dividers. It has two straight, removable legs tapered to a needle point mounted on separate holders which slide on steel (or wooden) bar and held in position by thumb screws.

3. Punches: It is used in sheet metal work for marking on sheet, locating centers. There are two types of punches. a) Dot punch and b) Prick punch.

These are already explained in fitting section in detail.

III CUTTING TOOLS:

To cut the sheet metal as per the pattern drawn and to make holes for rivets etc., the following types of tools are used.

A snip is a hand shear used to cut thin sheets of gauge size number 20 or above. It works like ordinary scissors. There are several types and sizes of snips available to cut along straight lines or curved lines.

Figure (a) shows a straight snip having straight blades to cut along straight lines. Figure (b) shows a bent

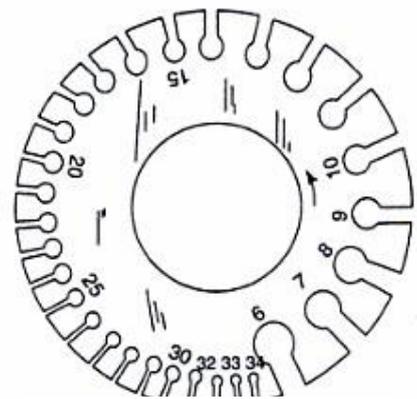


Fig . Standard wire gauge

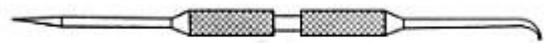


Fig . Scriber

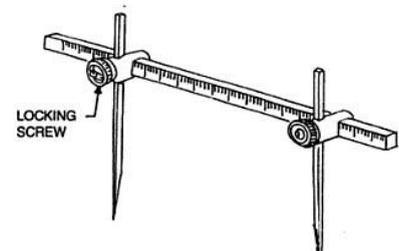
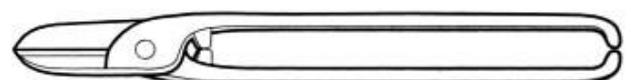
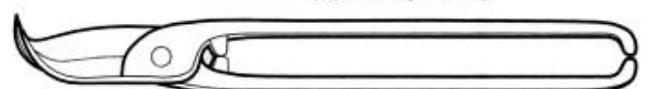


Fig . Trammel Points



(a) Straight snip



(b) Bent snip

snip having curved blades to cut along curved lines. These snips are used for cutting thin sheets. The heavier types are known as bench shear and block shear.

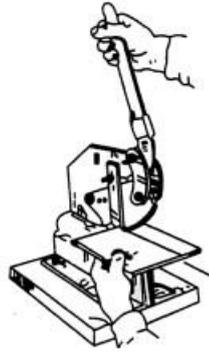


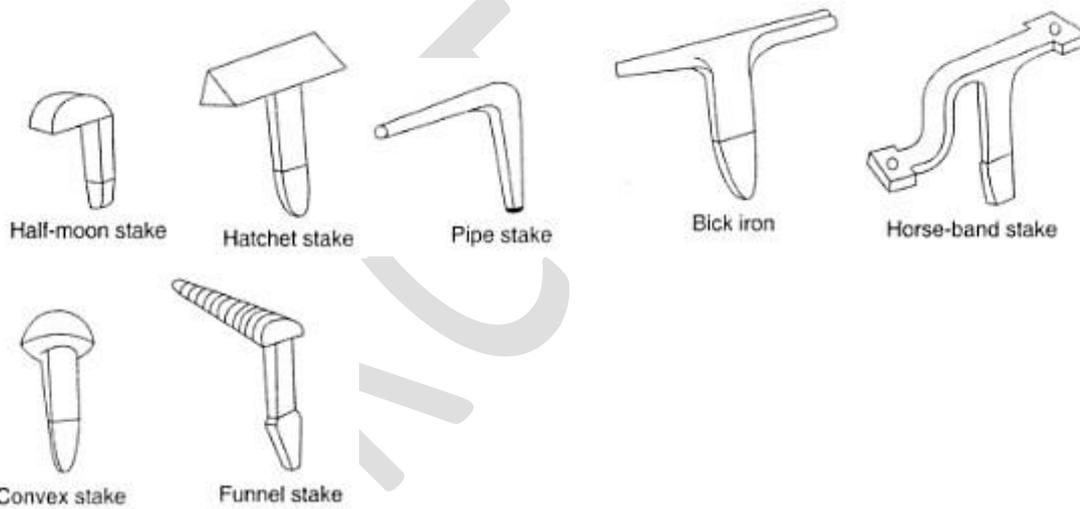
Fig. Mechanical Shearing press

IV. FORMING TOOLS:

Shaping of the sheet metal such as folding, bending, curling, etc., are done by using the following types of forming tools.

1. Stakes:

Stakes are the sheet metal anvils used for bending, seaming and forming by using a hammer or mallet. They work as the supporting tool as well as the forming tools. They are made in different sizes and shapes depending upon the job requirement. Commonly used stakes are



Stake Holder

The stake holder used in sheet metal shop is a rectangular bench plate as shown in Figure.

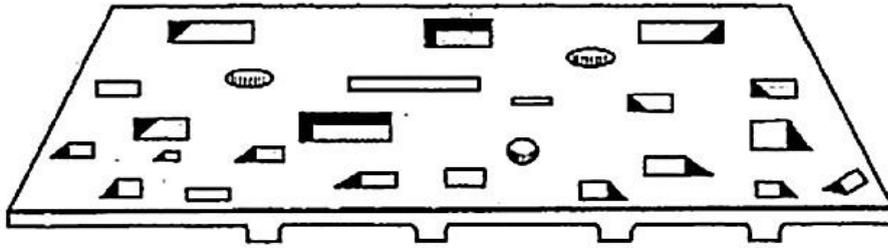
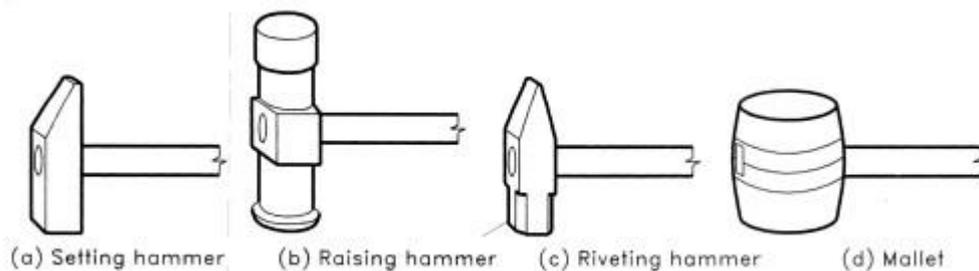


Fig. 12.16. Stake Holder.

Fig. Stake Holder

2. HAMMERS:

The sheet metal is shaped by hammering or striking with mallet, after keeping the work on suitable form of stake. The hammers used for sheet metal work are (a) *Setting hammer*, for setting down the edge while making double seam, (b) *Raising hammer* for forming curved or hollow shape from flat piece, and (c) *Riveting hammer* for riveting purpose. *Mallets* are soft hammers used to give soft blows which will not damage the sheet at the same time will shape them. The commonly used types of hammers and mallets are shown in Figure.

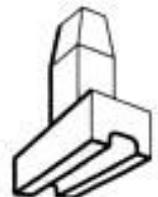


IV JOINING TOOLS:

The tools exclusively used for making and finishing joints are:

- a) Hand groovers b) Rivet set c) Soldering irons

Hand groovers: Hand groovers are used to flatten and shape joints made in sheet metal. The tool has a groove of required width and depth like a die. This groove is placed over the joint (double hem or lock seam) and hammered from the top of it, to shape the joint that of the groove as shown figure.



RIVET SET:

Rivet set is made of tool steel. At the bottom of the rivet set there is a deep hole and a cup-shaped hole. The deep hole is used to draw a rivet through sheet metal and cup shaped hole is used to form the finished head of the rivet- Another hole on the side of the set is to release the burrs that are punched. Dollies are used to backup rivets, when it is not possible to support the job on a bench.

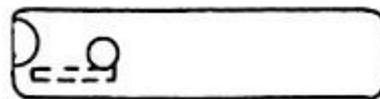


Fig. Rivet set

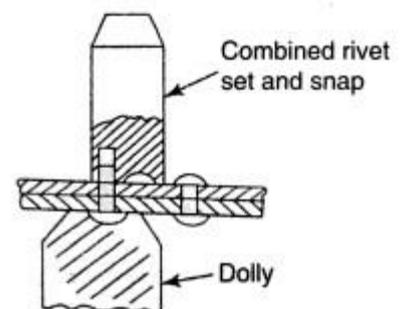


Fig. Rivet set and dolly

SOLDERING IRON:

A soldering iron consists of a copper block, fixed on an iron rod with a w... Fig. Rivet set and dolly various shapes and sizes to suit the use as shown in figure. The purpose of the copper block is to act as a

heat source for melting and spreading the solder (filler metal) at the joining area. The soldering iron (copper) is heated using furnace, blower or by electrical resistance.

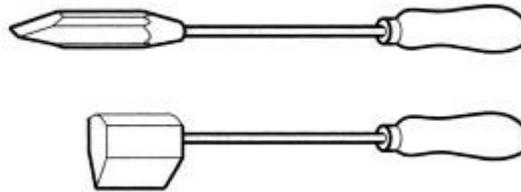
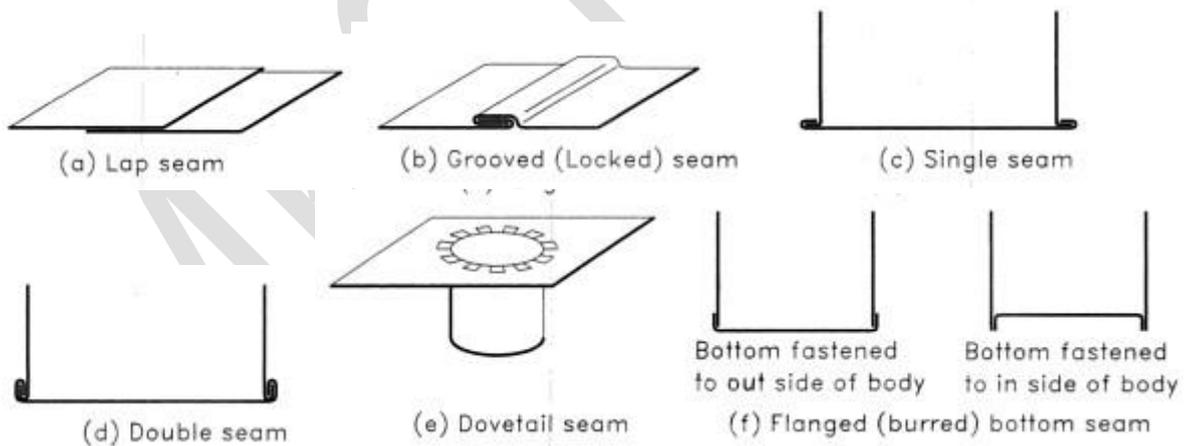


Fig. Soldering Iron

SHEET METAL JOINTS:

The line of joint on a sheet metal pieces is called seam. The most common types of seams are as follows:

1. **Lap seam:** This is the simplest seam used in sheet metal work (Figure (a)). This consists of one edge lapping over the other and joint is made by soldering or riveting.
2. **Grooved seam:** A grooved seam is made by hooking two-folded edges together and then offsetting them as shown in Figure 5.8(b). This joint is self-locking and stronger to some extent than lap seam.
3. **Single seam:** This seam is used to join a bottom portion to a vertical body as shown in Figure (c). The bottom edge is hooked over the bent edge of the vertical body. This method of joint can be used for square, rectangular or round containers.
4. **Double seam:** This seam is similar to single seam with the difference that the formed edge is bent upwards against the body as shown in Figure (d).
5. **Dove-tail seam:** This seam is used to connect a cylindrical piece to a flat as shown in Figure (e). The edge of the cylindrical part to be joined is slit at short distance and is bent so that alternate pieces come inside and outside of the joint. Permanent joint is obtained by soldering or riveting.
6. **Flanged (burred) bottom seam:** This seam is used to fasten the bottom of a container to its body. The flange of a cylindrical job is often called a burr. The joint consists of a narrow flange which may be joined to inside or outside of the vessel as shown in figure (f).

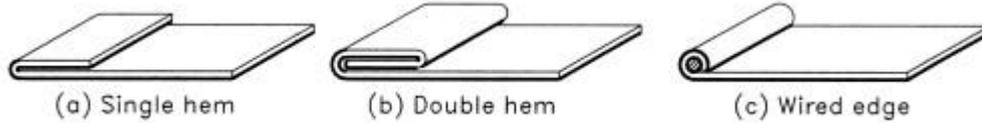


Edge Forming

For sheet metal objects strength is given to the edge and the sharpness is eliminated by folding the edge. The common types of folding used in sheet metal work are as follows:

1. Single hem
2. Double hem
3. Wired edge

Figure shows the three types of edge folding. A wired edge consists of an edge wrapped around a steel wire for better strength.



MARKETING MSOP