SECTION - FOUR

Sheet Metal

SAFETY PRECAUTIONS IN SHEET METAL SHOP

1. Avoid touching the cut portion while cutting with snip.
2. Use snips only for metal that can be cut by applied hand force.
3. Do not reach behind the shear blade to hold small pieces being cutoff. The tips of the fingers can not be seen and can easily be placed under the blade.
4. Do not try to hold small pieces of metal while they are being cut. They are liable to tip up and tip your finger in to the blades.
5. Do not try to bend the sheet with hands.
6. Use shoes and leather gloves.

DEFINITION

Working of thin sheets ranging from 10 gauge to 20 gauge, with simple machines and hand tools is considered as sheet metal work. Sheet Metal plays an essential role in all aspects of our everyday lives. Its many applications include agriculture, building construction, house hold, office, laboratory and shop equipment, heating and air conditioning and all kinds of transport. Common examples of sheet metal work are hoppers, boxes, cabinets, funnels, ducts, automobiles body and aircraft body. The sheet is cut into shape and folded to form the finished articles.

METALS USED IN SHEET METAL WORK

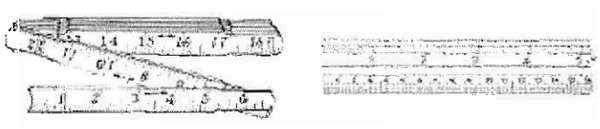
The two main groups of sheet metal are steel and non-ferrous, each group includes several types of metal for different uses.

Steel is the most commonly used material in the sheet metal shop. Sheet steel may be either coated or uncoated. The most commonly used coated sheets are galvanized and tin plate. Galvanized sheet metal is soft steel sheets coated with zinc. Air conditioning duct, roof flashing, tanks, boxes are usually made from galvanized sheet because of its low cost and good corrosion resistance. Stainless steel has high resistance to foreign or corrosive elements. For these reasons it is widely used in residential, institutional and restaurant kitchens for tables, sinks, and utensils.

Non-ferrous metals are those which have no iron or steel content. The most common non-ferrous metals used in the sheet metal shop are copper, aluminum, lead and zinc. Copper sheets are used for architectural purpose. Aluminum and lead sheets are used for roofs, gutters and down spouts in buildings. Zinc sheet is highly resistant to corrosion and is used in some instances where galvanized steel cannot provide adequate resistance.

SHEET METAL TOOLS AND MACHINERY

One of the characteristics of the skilled worker is the way in which he selects and uses the tools of his trade. For this reason, it is essential that worker should know how to select and properly use both the hand and machine tools of the sheet metal trade.



Folding Rule Steel Circuference Rule

Fig 4.1 Measuring Tools

MEASURING TOOLS

Steel Rule

Steel rules are manufactured in variety of lengths and types which are designed for measuring and laying out different work

Folding Rule

The six feet length folding rule is commonly used for taking job measurements in sheet metal work.

Steel Circumference Rule

This is used much like the common rule, is valuable for laying out patterns. Its length is 38 inches or 48 inches. The upper edge is having standard graduation whereas lower edge is designed for finding the circumference of a circle directly.

Wire Gauge

The thickness of sheet metal is identified by a series of numbers, called standard wire gauge (SWG) which is shown below. Higher the SWG number, lower is the thickness. A general rule for remembering the approximate thickness of the various gauge is that when the gauge number is increased by 6, the thickness is decreased by approximately ½. For instance 30 gauge sheet is thinner than 20 gauge sheet.

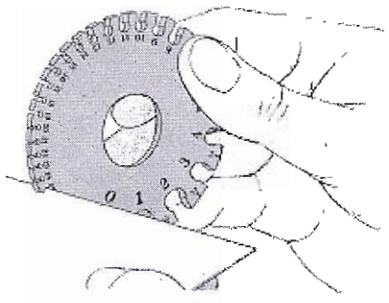


Fig 4.2 Wire Gauge

Standard Wire Gauge

Standard wire gauge (SWG).	10	12	14	16	18	19	20	22	24	26	30
Thickness in mm	3.2	2.6	2.0	1.6	1.2	1.0	0.9	0.7	0.6	0.4	0.3

Wire gauge refers to the tool used for measuring and determining the thickness of the sheet.

Standard gauge lengths are marked on the face of the wire gauge as shown in Fig.4.2. Wire gauge generally has gauge numbers varying from 1 to 38. The measurement is made by sliding the slot over the edge of the sheet. The number corresponding to the best fit slot is the gauge number.

MARKING TOOLS

Sheet metal marking tools are used to scribe or measure lines, perform layout operations

SCRIBERS

There are three common types of Scribers shown in Fig. 4.3. All three scribers perform the same function of marking lines on metals. Lines are marked on metal for a variety of purpose in laying out patterns.

Ring Scribers

The ring scriber is made of one solid piece of steel approximately eight inches long with a tapered point on one end and a ring on the other.

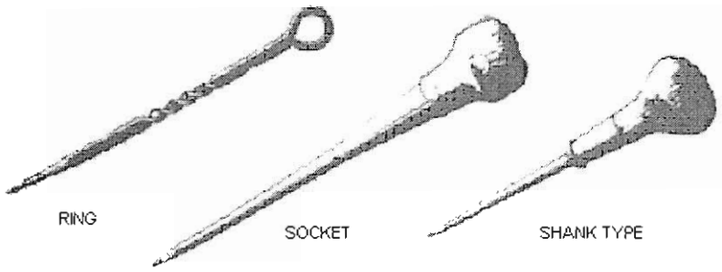


Fig 4.3 Types of Scribers

Socket Scribers

The socket scriber has a steel blade approximately five inches long and is made with a replaceable wooden handle.

Shank Type Scribers

For general purposes, this shank type of scribers is preferred by most sheet metal mechanics since the steel blade passes through the handle, reinforcing the top.

DIVIDERS

Dividers are made with each straight leg tapered to a needle point. These wing type dividers may be adjusted to any position by loosening the knurled screw, changing the distance between needle points and then tightening the screw to retain the desired distance between tips. Dividers are manufactured in a number of sizes and types and are used to space off equal distances, to divide lines into equal parts and to scribe arcs and circles.

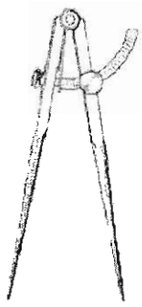


Fig 4.4 Divider

STEEL SQUARE

The steel square shown in Fig.4.5. is invaluable for accurate layout work in pattern drafting since all layouts must start from a square corner. The long arm of the square is known as the body (also called blade), and the short arm is called the tongue. Squares are manufactured in a number of sizes.

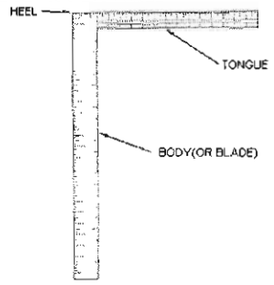


Fig 4.5 Steel Square

TRAMMEL POINTS

Trammel points (sometimes called a beam compass)are instruments used for drawing large circles, arcs, etc. They are manufactured in various types with two straight, removable legs tapered to needle points and attached to separated heads or holders.

PUNCHES

Punches are generally used for making small dents or marks on sheet. Great care should be used in order to select the proper punch for each operation. The common hand punches are shown in fig.4.6

Prick Punch

Prick punches are made of tool steel and have a tapered point ground to approximately 30° included angle. These punches are used for making small dents or indentations, and/or establishing points for dividers and trammel points.

Center Punch

Center punches are similar in design to the prick punch, except that the tapered point is ground to an angle of approximately 90° .They are used primarily for marking the location of points and the centers of holes to be drilled. Such punches are manufactured in various sizes and may be purchased in sets.

Neither prick punches nor center punches should be used to punch holes. There are both intended for establishing points only.

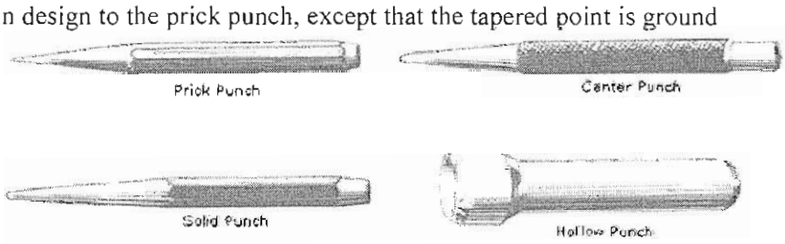


Fig 4.6 Common Types of Punches

Solid punch

Solid punches are used to punch small holes in light gauge metal. These punches may also be purchased in sets of various sizes.

Hollow Punch

Hollow punches, are used for cutting circular holes, ¼ inches or larger from sheet metal. To avoid chipping the edges of the hollow punch, the sheet metal should be placed over a block of lead.

STRIKING TOOLS

HAMMERS

It is essential that sheet metal workers have a variety of hammers. These should include the following; Riveting hammers, Raising hammers, Setting hammers, ball peen or Machinist's hammers, Nail hammers, and Mallets [fig 4.7]. These hammers are manufactured in a variety of weights.

Riveting Hammer: The riveting hammer has a square, slightly curved face with beveled edges to prevent the head of the hammer from marking the metal. The peen side is double tapered and has slightly rounded end.

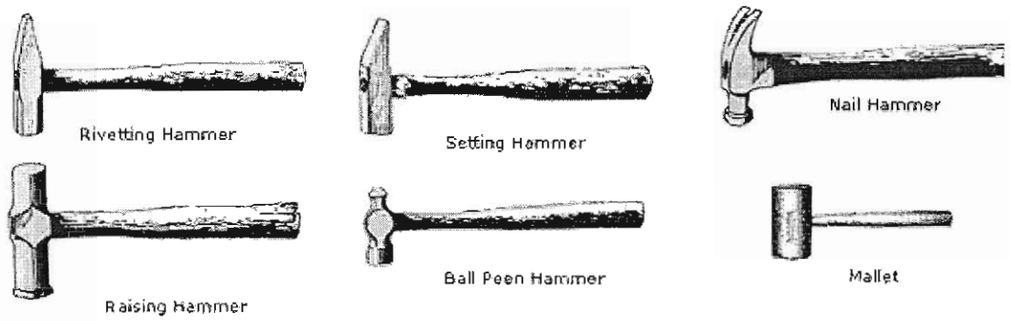


Fig 4.7 Types of Hammer

Setting Hammer: The setting hammer has a square, flat face for flattening seams without damage to the metal. The single-tapered peen with a beveled end is used for peening operations.

Ball Peen Hammer: The ball peen or machinist's hammer has a round, slightly curved face and round head. It is a general purpose hammer.

Raising Hammer: The raising hammer is seldom used in modern sheet metal work. It is one of a set of four hammers used in raising circular disks and ornaments for cornice work and many other raising and bumping operations.

Common Nail Hammer: The common nail hammer is not generally considered a sheet metal worker's tool, though it is very useful in this work and is employed for a variety of operations around the shop. Nails can be hammered or removed with this hammer.

Mallet: Mallets are used where steel hammers would deface the work. A good grade of hard fiber mallet will last a long time if used in the correct manner on proper materials.

CUTTING TOOLS

Snips

Snips are hand shear, varying in length from 200mm to 600mm. A brief description of blade types and the snips in most common use is given below.

Blade type

The blades are of two basic types either straight blade or combination blades. Fig.4.8. shows the difference between the straight and the combination blade. The cross sectional view of the two types shows that the straight blades have the face of the blade running straight up from the cutting edge, while the combination blade is curved back from the cutting edge.

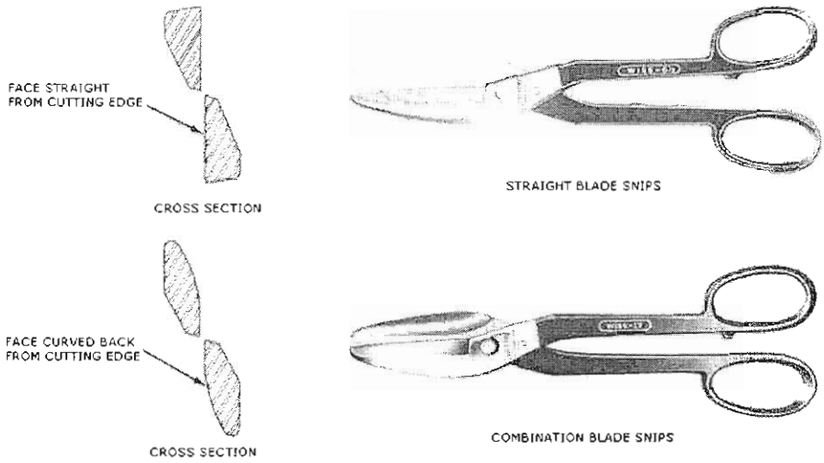


Fig 4.8 Blade Snips

In use, the difference between the two is that the combination blade allows the metal to slide over the top blade when cutting curves, as shown in fig. 4.8. The straight blade snips does not allow the metal to curve over the top blade and is therefore best for cutting straight lines and along outside curve. Also, straight blades, because of their design, have a greater amount of metal to strengthen them and therefore the blades can be made in greater length than is possible with the combination blade.

General Purpose Snips: General purpose snips may be either combination or straight blade snips, though the combination blade is the most commonly used by sheet metal workers. The snips are used for all routine cutting. General purpose snips are usually used on 26 gauge or lighter.

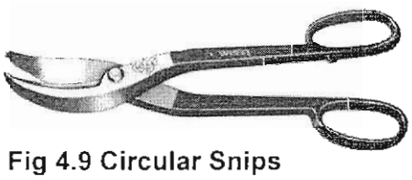


Fig 4.9 Circular Snips

Fig 4.10 Bench Shears

Circular Snips

Circular snips (Fig 4.9) have blades that curve sideways. They are designed for cutting inside circles and also for cutting metal close to an obstacle, such as when trimming of a metal duct flush to a wall.

Bench Shears

Bench shear shown in Fig.4.10 are designed to fasten onto the bench for heavy cutting. The bottom handle is bent at a right angle and is square in shape to fit into a square hole on a metal bench plate. These shears are two to three feet long and are used for cutting sheet metal which is 1/10 inch thick, or more.

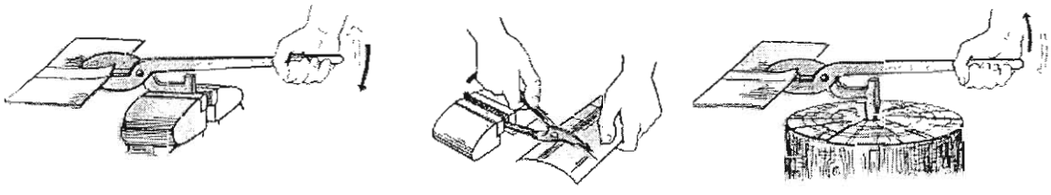


Fig 4.11 Usage of bench shear

PLIERS

Various types of pliers, shown in Fig.4.12 are used in sheet metal work for holding, cutting and bending work.

Flat-Nose Pliers

Flat-nose pliers have flat jaws with small grooves and are used for forming and holding work.

Round-Nose Pliers

Round-nose pliers have long jaws rounded on the outside and are used in holding and forming the various shapes and patterns.

Slip-Joint Combination Pliers

Slip-joint combination pliers are constructed with an adjustable jaw. These pliers are a general-purpose tool.

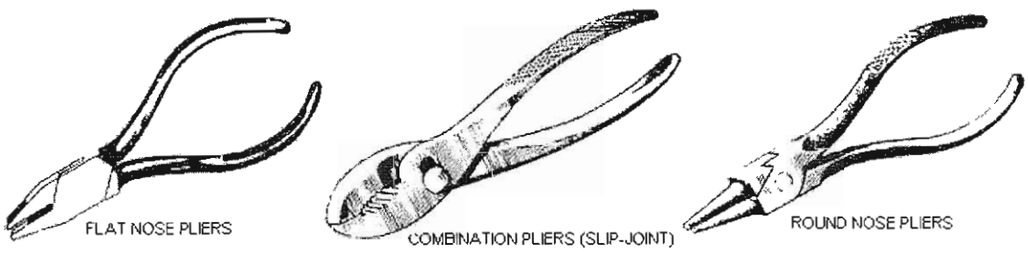


Fig 4.12 Types of pliers

BENCH STAKES

The anvils are referred to as stakes and are designed to perform many operations for which machines are not available or readily adaptable. Stakes are available in a variety of shapes and size as shown in fig.4.13. The parts of a stake are the shank, the head, and the horn. The shanks of the stakes are generally standard, head and horns are available in various shapes and sizes. The shank of each stake has a tapered point, which fits the holes in the bench plate, shown in fig. 4.14.

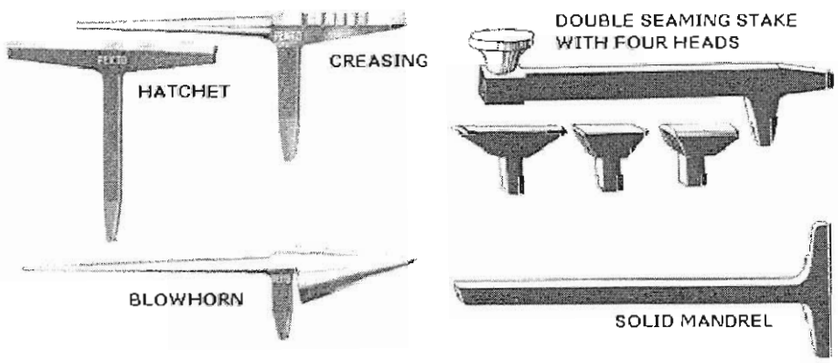


Fig 4.13 Types of Bench Stakes

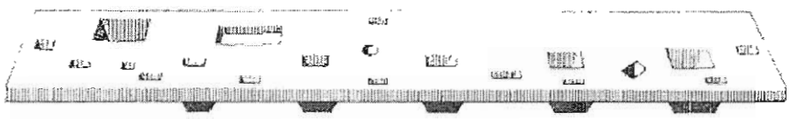


Fig 4.14 Bench Plate

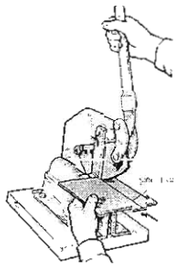


Fig 4.15 Bench lever shear

MACHINERY

Bench lever shear

A shear which is used in sheet metal shop is shown in fig.4.15. The working principle is the same as snips except that they are built stronger and have a compound leverage system for greater power. The blades are designed to cut curves and circles as well as straight lines.

Press Brake

Press brake is a machine used for bending sheets. It bends the metal by pressing it into special dies. It is better suited to a large number of the same operations rather than doing many different operations. Press brakes are available in all sizes from 4 feet long up to 35 feet long.

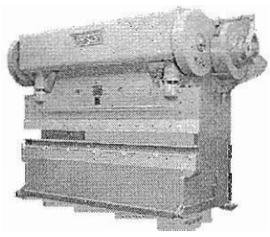


Fig 4.16 Press brake

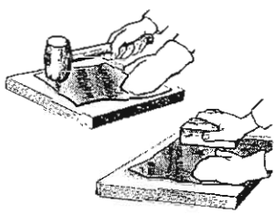


Fig 4.17 Straightening

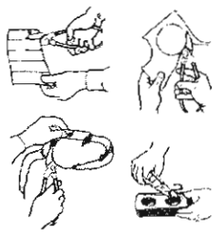


Fig 4.18. Shearing

SHEET METAL OPERATIONS

Straightening: Metal sheets or blanks cut from sheet material may have waves or bulges. The work is put on the plate so that the warped edges fully rest on the plate surface and is firmly held down by hand. In the course of flattening, the work is hammered from the middle towards the edge. Thin sheets are flattened with light wooden hammers or mallets whereas very thin sheets are flattened on a plate with metal or wooden blocks.

Shearing

Shearing is cutting a required profile from a sheet metal using hand shear or snip along the layout. Some examples are given in Fig.4.18.

Piercing

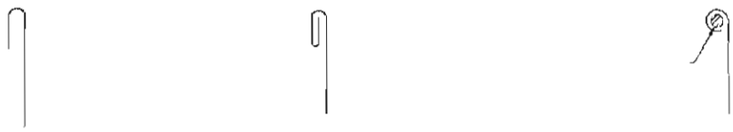
It is the operation of production of a hole in a sheet metal by the punch and die. Here the cut portion is scrap.

Blanking

Blanking is the operation of cutting a piece of the required shape from a sheet using a punch and die. Here the cut portion is the required component.

Hemming

Hemming refers to the process of folding over the edge of a piece of sheet metal and then pressing it to make it flat. This stiffens the sheet and creates safer, non-jogged edge. Hems can be classified into three categories namely single hem, double hem, and wired edges.



(a) Single hem **(b) Double hem** **(c) Wired edges**

Fig 4.19 Types of hem

Seaming

In sheet metal construction, there are a variety of methods for joining the edges of sheet metal. These methods, however, may be generally classified as either mechanical or welded. The choice of the seam is determined primarily by the thickness of the metal, the kind of metal, the cost of fabrication, and the equipment available for making the seam. However, it is obvious that the mechanical seam is used when joining light and medium gauge metal and that, a riveted or welded seam is necessary when joining heavier gauge metal.