

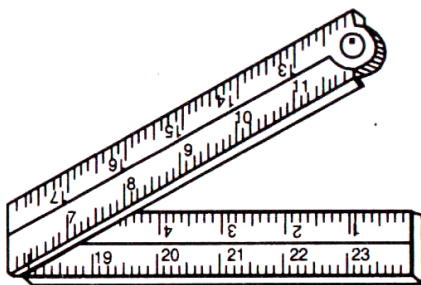
**SHEET METAL**

## **INTRODUCTION**

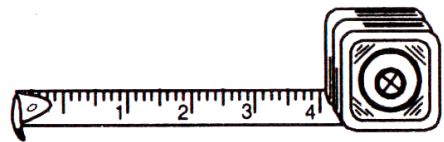
The sheetmetal shop is very important for every engineering concern. It deals with the working of metal sheets. It requires a through knowledge of projective geometry particularly the development of surfaces, because the laying out of pattern and cutting of metal sheets to correct sizes and shapes entirely depends upon the knowledge of the workman.



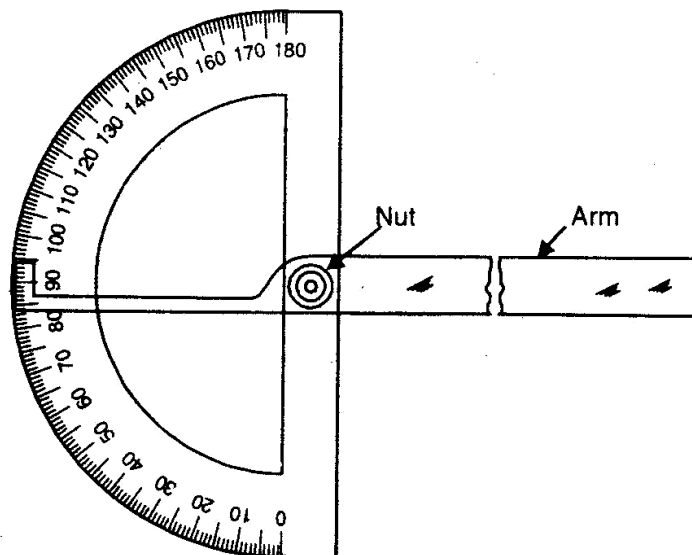
Steel Rule



Folding Rule



Steel Tape



Singing Blade Protractor

## METALS USED IN SHEET METAL WORK

The following metals are generally used in metal work.

### **(a) Black iron sheet**

It has a bluish -black appearance and is often referred to as uncoated sheet. Since it is uncoated , therefore, it corrodes rapidly.

### **(b) Galvanised iron**

It is soft steel coated with molten zinc. The zinc coating resists rust, improves the appearance of the metal, and permits it to be soldered with greater ease. This sheet is used in fabricated products such as pans, buckets, furnaces, heating ducts, cabinets, gutters and in many other articles.

### **(c) Copper**

It is a reddish coloured metal and is extremely malleable and ductile. It is used extensively in the electrical field.

### **(d) Aluminium**

It is silvery white coloured metal and has many qualities like high ratio of strength to weight, corrosion resistant qualities and ease in fabrication.

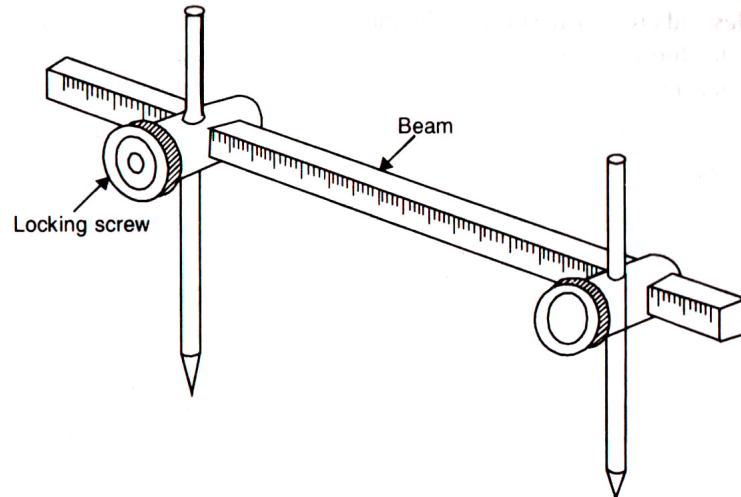
### **(e) Stainless Steel**

It is an alloy steel possessing the ability to resist corrosion without any surface coating. One important type of stainless steel contains 18% chromium and 8% nickel. It is widely used in building stream lined trains, food handling equipments, kitchenwares and in many other applications which require great strength and resistant to corrosion.

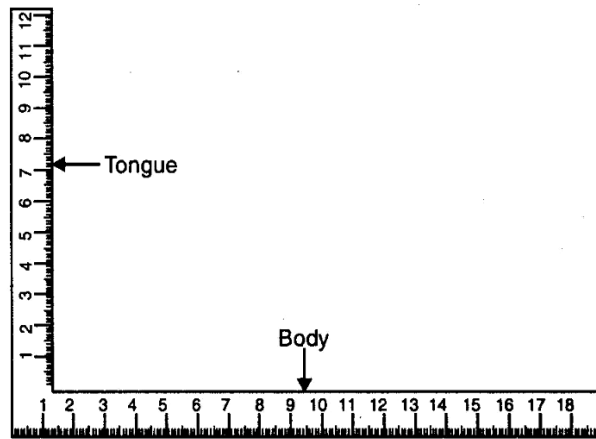
## SHEET METAL TOOLS

**Rules :** The rules are available in a variety of lengths and types, each of which is designed for measuring and laying out different work.

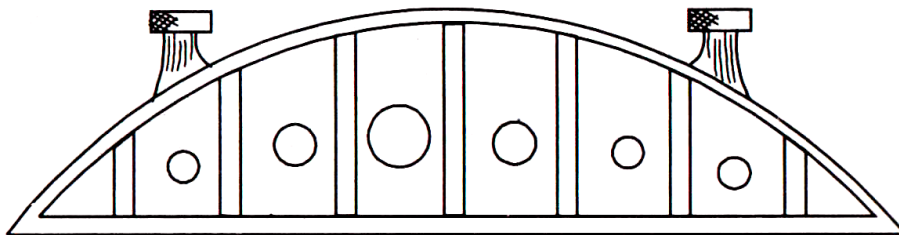
**Folding rule :** The folding rule is very helpful in measuring and laying out large work. In order to measure accurate distance, the rule should be placed on its edge so that the graduations are in actual contact with the metal.



Trammel Point



Steel Square



Straight Edge

**Steel square** : It is L-shaped piece of hardened steel with graduation marks on the edges for measuring. The narrow arm of the square is called the tongue and the wide part is known as the body.

**Straight Edge** : It is a flat bar of steel with a bevelled edge. This bar comes in a variety of lengths ranging from one meter to 3 meter. It is useful for drawing long lines.

**Scratch awls or Scribers** : They are used to scribe or mark lines on a metal surface of a variety of purposes in laying out patterns. They are three types, (a) *Ring scratch awl*, (b) *Socket scratch awl* and (c) *Shank type scratch awl*.

**Dividers** : The dividers are made with each leg tapered to a needle point. The two types of the dividers are the spring and the wing divider. The leg of the spring divider are adjusted by turning the knurled nut. The adjustment , on the wing divider is made by loosening the screw on the wing and then tightening the knurled nut on the end of the wing.

**Trammel points** : The trammel points, consists of two straight , removable legs tapered to needle points and attached to separate heads. These heads or holders slide on wood or steel bars or beams and are held in place by thumb screws. A special clamp for a pencil can be attached to one of the points. The trammel points are used to draw large arcs and circles that are beyond the limit of dividers.

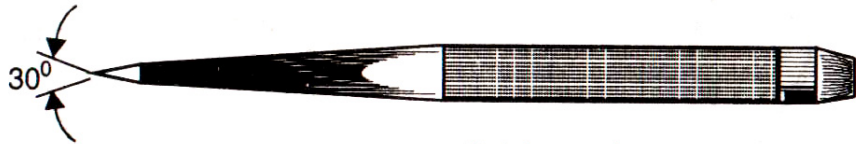
## **Punches**

**(a) Prick punch** : The prick punch, is a tool steel rod whose one end has tapered point ground to approximately an included angle of  $30^\circ$ . It is used for making small indentations or establishing points for dividers and trammel points.

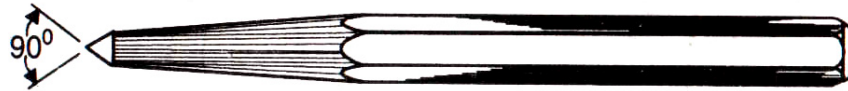
**(b) Centre punch** : The centre punch is similar to prick punch, but its point is ground to an angle of approximately  $90^\circ$ . It is used to mark the location of bend lines on heavy metal and to mark the centres of holes to be drilled.

**(c) Solid punch** : The solid punch is used for punching small holes in thin sheets.

**(d) Hollow punch** : The hollow punch is used for punching holes upto 10mm or above from metal sheets. The inner and outer faces of the punch meet at an angle of  $40^\circ$ .



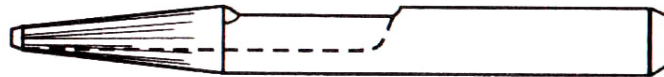
Prick punch.



Centre punch.

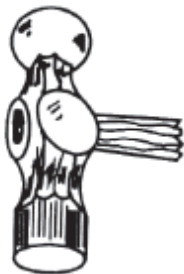


Solid punch.

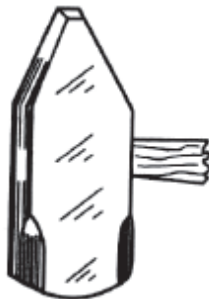


Hollow punch.

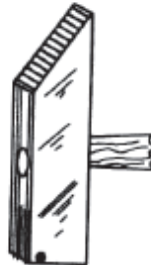
### HAMMERS



Ball peen



Rivetting



Setting



Hollowing or  
Blocking



Raising



Planishing



Collet



Tray

**Chisels** : The cold chisel is used to cut or shear metal. It is made from a piece of high carbon or alloy steel of hexagonal or octagonal in shape.

There are many different types of chisels, but the flat chisel is mostly used for cutting sheet metal, rivets, bolts and in chipping operations.

**Snips** : The snips are somewhat similar to a pair of scissors but are considerably heavier. There are several types of snips available for making straight or circular cuts, but the most common are the straight snips and the curved snips.

The straight snip has straight blades for straight line cutting. These snips may be obtained in various sizes.

The curved snips has curved blades for making circular cuts. They are available for either right hand or left hand cuts.

## **Hammers**

The hammers, in sheetmetal work, are used for forming shapes by hollowing, raising stretching or throwing off processes. They are many types of hammers, but the most commonly used hammers, in sheet-metal work are follows:

**(a) Ball peen hammer** : The ball peen hammer has a round, slightly curved face and a round head. It is general purpose hammer.

**(b) Rivetting hammer** : The rivetting hammer has a square, slightly curved face with bevelled edges to prevent the head of the hammer from marking the metal. The peen side is double tapered and has a slightly rounded end. It is used for spreading rivets and for hammering a rivet set.

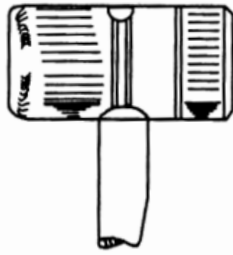
**(c) Setting hammer** : The setting hammer has a square, flat face and a tapered peen with bevelled end. The flat face is used for flatterring seams without damage to the metal while peen end is used for peening operation.



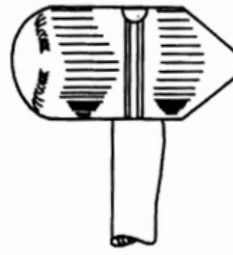
## MALLETS



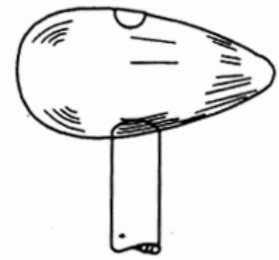
Flat peen



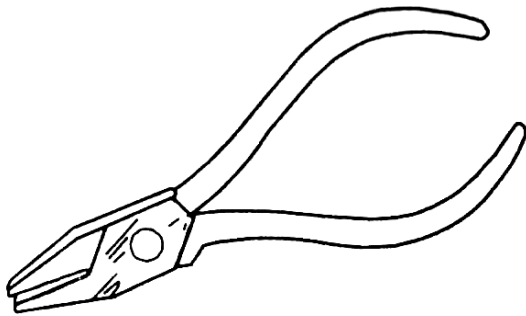
Straight peen



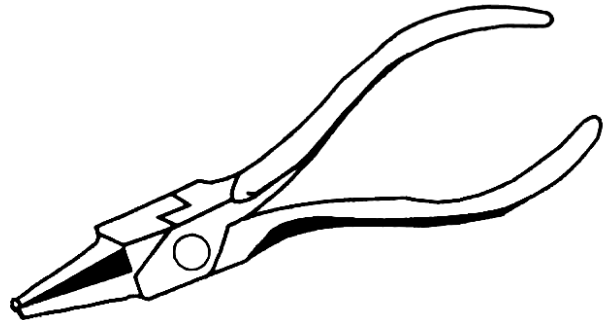
Cross peen



Bossing

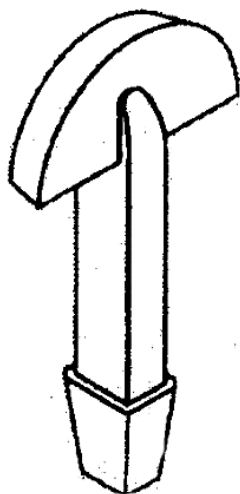


Flat nose plier

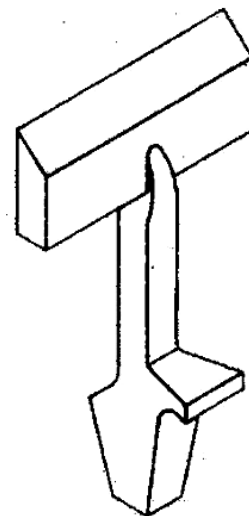


Round nose plier

## STAKES



Half Moon Stake



Hatchet stake

**(d) Hollowing or blocking hammer :** The hollowing or blocking hammer has a dome face without any sharp corner. It is used for hollowing discs into bowl shapes.

**(e) Raising hammer :** The raising hammer has an oblong flat face with corners slightly rounded off. It is used in raising circular discs and many other raising and bumping operations.

**(f) Planishing hammer :** The planishing hammer has a round face. It is used on domed circular work.

**(g) Collet hammer :** The collet hammer has an oblong shaped faces. It is used on cylinders and in curved collects.

**(h) Tray hammer :** The tray hammer has oval shaped faces. It is used to sink the bottom when shaping a tray.

**(i) Mallets :** The mallets may be made from hide, fibre or wood. The best size of mallet is 5cm diameter. These may be obtained in various shapes to suit special work.

### **Pliers**

The pliers are used in sheet metal work for holding, cutting and bending work.

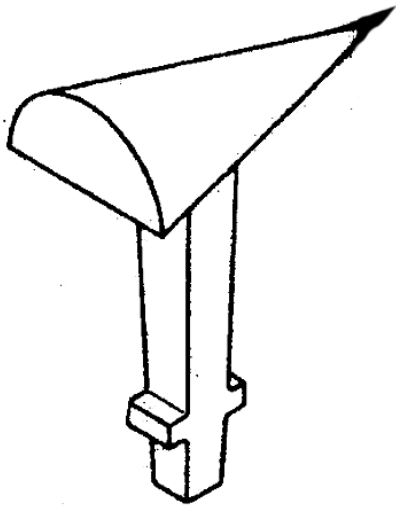
**(a) Flat nose plier :** The flat nose plier has flat jaws with small grooves. It is used for forming and holding work.

**(b) Round nose plier :** The round nose plier has long jaws rounded on the out side. It is used for holding and forming the various shapes and patterns.

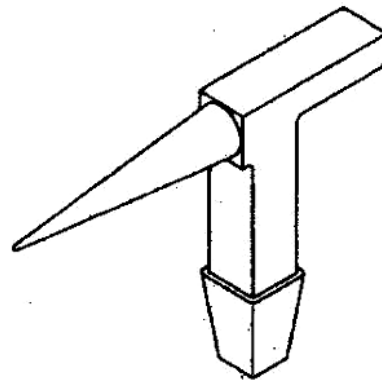
### **Bench Stakes**

The stakes are steel anvils used to perform operations like bending, seaming or forming on sheet metal, when suitable machines are not available. The stakes are available in various shapes and sizes.

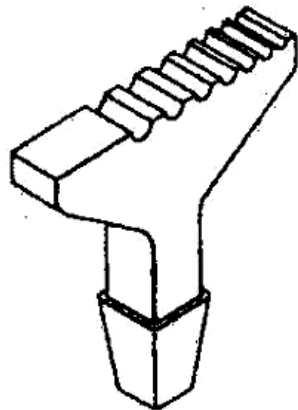
**(a) Blow horn stakes :** The blow horn stakes has a short tapered horn at one end and a long tapered horn at the other end. It can be held in a vice or in square hole in a wooden block or bench top. It is used for forming, rivetting operations.



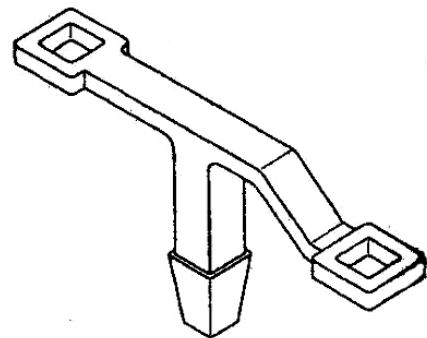
Funnel Stake



Bickiron Stake



Creasing Stake



Horse Stake

**(b) Beak horn stake :** The beak horn stake has a round tapered horn at one end and a square tapered horn at the other end. The round tapered end may be used for many purposes like bending of sheet metal into cylinders and conical shapes, for setting down seams when used with a grooving punch or a seam set, for truing work to make circular when the seam is folded or soldered etc.

**(c) Hatchet Stake :** It consist of a horizontal sharp straight edge and is used for making sharp bends, folding the edges of the sheet metal.

**(d) Half Moon Stake :** This stake has a sharp edge in the form of an arc of a circle, bevelled along one side. It is used for circular folding and seaming.

**(e) Funnel Stake :** This stake is used when shaping and seaming funnels and tapered articles.

**(f) Creasing Stake :** This has two rectangular shaped horns. One is plane and the other contains a series of grooved slots of various sizes. This slots are used for wiring 'sinking' a bead on the straight edges of the flat sheet, and for making small diameter tubes with thin gauge metal.

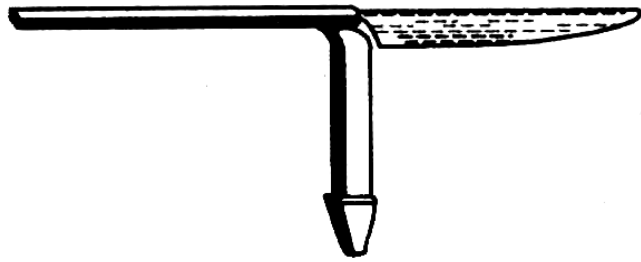
**(g) Planishing Stake :** This is slightly polished on its working surface and is used for planishing all types of flat and shaped works.

**(h) Horse head Stake :** It is double ended holder for small stakes - one of which is cranked downwards for clearance purpose and has square holes at both ends. It is used for working beads, flats etc. on cylindrical work.

**(i) Bottom Stake :** It consists of a single vertical piece with a flared end. This is used mostly for burring or flanging circular bottoms by turning the edges of discs at right angles to fir circular stake.

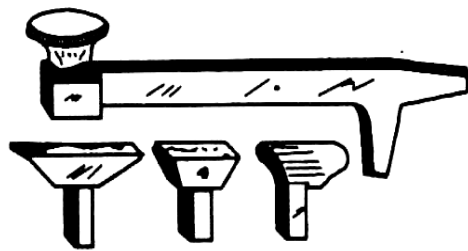
**(j) Hollow mandrel Stake :** It is single horizontal metal piece, one end of which has a flat surface while the other end has round section. The rounded section has a slot which permits the stake to slide on a bolt so that it can be fastened on different positions on the bench. The stake is used for rivetting, seaming and forming.

Beak horn stake

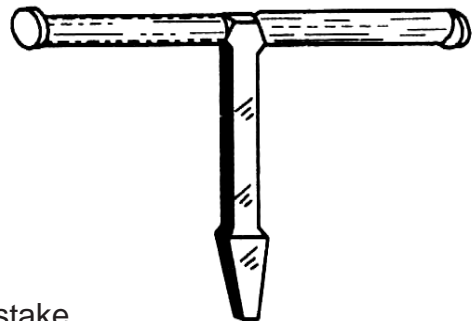


Bevel Edge Stake

Solid mandrel Stake



Double seaming stake



**Solid mandrel Stake :** The solid mandrel stake has a double shank so that the rounded or flat side can be used to perform operations similar to those of hollow mandrel stake.

**Double seaming Stake :** The double seaming stake with four heads has a horizontal bar with a hole at one end into which any of the four different heads may be inserted. The bar has a double shank so arranged that the stake may be used either horizontally or vertically. it is used for double seaming large work.

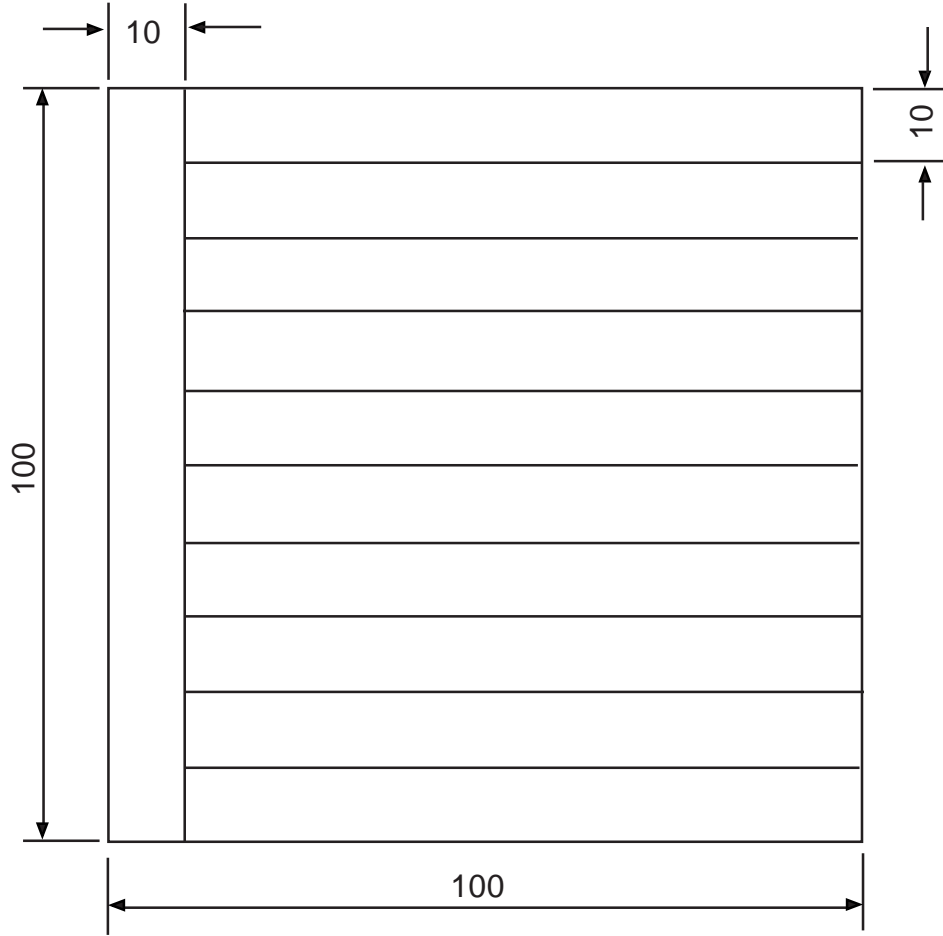
**Bevel edge Stake :** The bevel edge stake has a flat and square head with a bevel edge on the outside of the head of double seaming. It also has an offset shank which permits the work to clear the bench.

In sheet metal work, black iron, galvanized iron, copper, aluminium, stainless steel, and tin plates etc. are used in the form of sheets or plates. Usually metal plate of thickness less than 5 mm is considered as a sheet metal. The sheets are specified in thickness by standard wire gauge numbers.

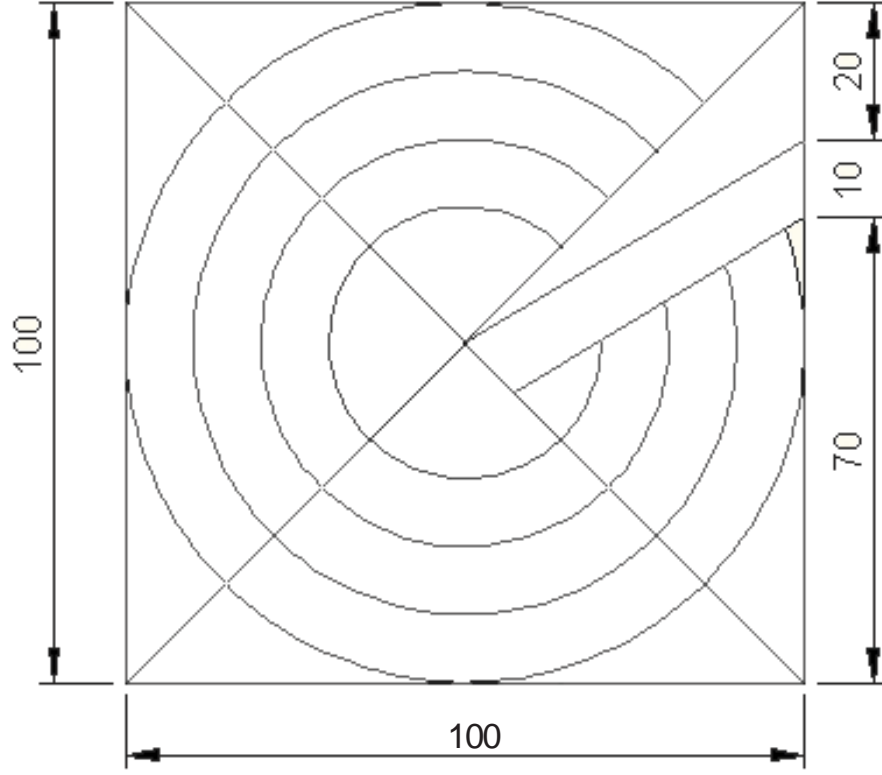
The thickness of the sheets vary inversely as their gauge number. The higher the gauge number, the smaller the thickness and vice versa. The table shows the thickness of the sheet in millimeters and corresponding gauge number.

Gauge No.	Approx. Thickness in mm	Gauge No.	Approx. Thickness in mm	Gauge No.	Approx: Thickness in mm
00	8.729	12	2.517	25	0.560
0	7.937	13	2.240	26	0.498
1	7.142	14	1.994	27	0.443
2	6.846	15	1.775	28	0.396
3	6.073	16	1.587	29	0.353
4	5.895	17	1.412	30	0.315
5	5.312	18	1.257	31	0.276
6	4.935	19	1.118	32	0.256
7	4.770	20	0.996	33	0.236
8	3.998	21	0.886	34	0.251
9	3.551	22	0.794	35	0.185
10	3.175	23	0.707	36	0.177
11	2.827	24	0629		

1. Straight Line Cutting



2. Round Cutting Practice



All dimensions are in 'mm'

## Models for Practice

### 1. STRAIGHT LINE CUTTING PRACTICE

Material :

Tools used :

Operations :

Procedure :

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### 2. ROUND CUTTING PRACTICE

Material :

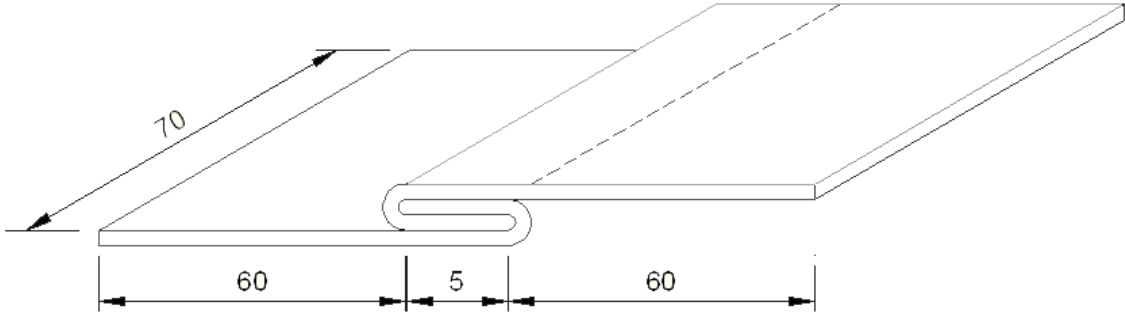
Tools used :

Operations :

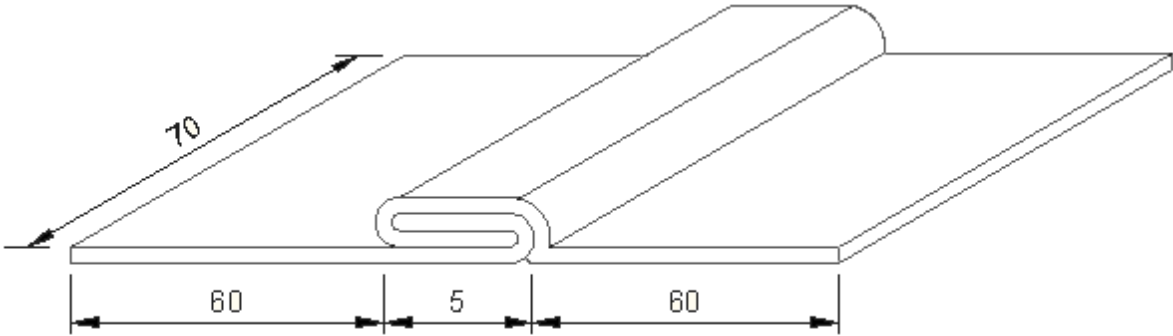
Procedure :



3. Single Grooved Joint



4. Locked Grooved Joint



### **3. SINGLE GROOVED JOINT**

Material :

Tools used :

Operations :

Procedure :

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### **4. LOCKED GROOVED JOINT**

Material :

Tools used :

Operations :

Procedure :