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SHEET METAL WRITEUP

INTRODUCTION

Sheet metal is simply metal formed into thin and flat pieces. It is one of the fundamental forms used in metalworking, and can be cut and bent into a variety of different shapes. Countless everyday objects are constructed of the material. Thicknesses can vary significantly, although extremely thin thicknesses are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate.

heet metal is not a specific material. Rather, the term is used for metals that have been formed into shape. As a rule, sheet metal has a rectangular shape. It is also characteristic that the thickness of a sheet is considerably below that of its length and width.

In addition to steel, numerous other metals such as copper, aluminum and gold as well as brass alloys can be processed into sheet metal. In order to be processed into sheet metal, however, the materials used should have specific characteristics, i.e. a certain toughness and rigidity, and of course be ductile, i.e. formable. These requirements result in restrictions with regard to the materials that can be used. Thus, it is not possible to process very brittle or extremely stiff materials into sheet metal.

According to this, sheet metal is a semi-finished product that can be produced over a large area, whereby sheets are generally light, thin, stable, elastic and flat. Due to these specifics, they are suitable for all types of cladding and covering. In addition, sheet metal can be deformed in many ways, i.e. it can be welded, bend, punched or cut. A wide variety of shapes can be made from sheet metal, which is why it is used as the starting material for a wide variety of products.

Metal Forming Process

Forming can be defined as the process in which the desired size and shape of the object are obtained through plastic deformation of material. The stresses induced during the process are greater than yield strength but should be less than the fracture strength. Different types of loading may be used depending on the process.

- Tensile
- Compressive
- Shear
- Bending

Classification of Metal Working Process

Metal working process may be classified as the ease with which metal may be formed into

useful shapes by-

- Plastic deformation process
- Metal removal process

a) **PLASTIC DEFORMATION PROCESS**

In this the volume and the mass of the metal are conserved and the metal is displaced from

one location to another.

b) **METAL REMOVAL PROCESS**

In this the material is removed from the stock in order to give it required shape.

Classification of Metal Forming Process

Metal forming process may be classified on the basis of type of forces applied to the work

piece as it is formed into direct shape.

- Direct compression type process

(e.g.-Forging, Rolling)

- Indirect compression process

(e.g.-Extrusion, Wire Drawing)

- Tension type process

(e.g.-Stretch forming)

- Bending process
- Shearing process

These categories are:

1) Direct – compression – type process

2) Indirect – compression processes

3) Tension type processes

4) Bending processes

5) Shearing processes

Manufacturing process of sheet metal processing

In the following, the different manufacturing processes of metal processing and sheet metal working are presented.

1. Forming - rolling, bending, forging, drawing

With this manufacturing process, the cohesion of the material is maintained. However, in the course of sheet metal processing, the already existing shape of a workpiece is modified by plastic deformation. An example of forming in metal processing is the rolling of steel. In general, plastic deformation occurs in the forming process when the atoms, which are located on the so-called sliding planes, begin to shift as a result of external forces. The modifications of the technological and physical properties of the material occurring during sheet metal processing are subsumed under the term "hardening".

In general, the resistance to deformation of metals at room temperature is higher than at a corresponding forming temperature. Plastic forming of steel, for example, can be achieved at high temperatures with far

less work and effort than at room temperature. In addition, high temperatures during sheet metal processing contribute to the immediate recrystallization of the microstructure and do not lead to hardening.

Cold and hot forming

In sheet metal forming, a distinction is made between hot and cold forming. Hot forming is a sheet metal forming process in which greater formability is achieved at high rolling temperatures, whereby the occurring forces are lower than in cold forming. The disadvantages of hot forming, however, are its poorer dimensional tolerances and scored surfaces.

In contrast, much more precise dimensional tolerances can be achieved in the cold forming process within the framework of metal processing. In this method of sheet metal working, the material is not heated, which increases its strength. In contrast to cold forming, the quality of the surfaces is also of high quality. A disadvantage, however, is that no welding suitability is ensured after cold forming. The workpiece can only be welded when it has been soft annealed in the course of sheet metal processing, thus minimizing stress.

2. Separation - cutting, punching,

Within the framework of the separating manufacturing process, which according to DIN 8580 also forms a main group among the manufacturing processes, the shape of a solid body, i.e. workpiece, is changed by locally eliminating, i.e. reducing, the cohesion. In this form of sheet metal processing, the final shape of the workpiece is therefore contained in its original form. Separation is a technique of metalworking, which also includes the dismantling of composite bodies. The main group "Separation" can be subdivided into six subgroups. There are the following subgroups:

- Splitting
- Ablation
- Disassembling
- Cleaning
- Machining with geometrically determined cutting edges
- Machining with geometrically indeterminate cutting edges

Cutting processes in sheet metal working include sawing, milling, filing, drilling, turning, lapping, thermal cutting, broaching and honing. Wedge cutting and shear cutting, on the other hand, are separating processes. During metalworking, the actual cutting process takes place at the point of action, i.e. at the point where the tool or machine acts on the workpiece. With regard to the cutting process in sheet metal working, it should be noted that relative movements, i.e. cutting, feed and infeed movements, are necessary and are carried out by one of the active partners. The power or energy supplied from outside to carry out the separation process is converted into friction, deformation and separation power at the point of action. They are dissipated in the form of heat via the active pair.

3. Joining - welding, soldering,

Joining, too, is one of the main production groups in sheet metal processing manufacturing technology defined by DIN 8580. Within the framework of this metalworking process, two or more solid bodies are permanently joined together. It is important that the bodies take on a specific geometric shape through sheet metal processing. Partly this is done by using a "formless material", i.e. the shape of the material is not defined. For example, adhesive counts as a formless substance.

oining also has further process groups that belong to metalworking. These are for example soldering, welding, gluing as well as screwing, joining by shearing and upsetting or riveting. In order to establish a connection between the workpieces, further components such as pins, screws, wedges or rivets are sometimes necessary. In addition, specific tools such as soldering irons, impact wrenches and so on are used in this production technology.

4. Surface treatment

In metalworking, the term "surface technology" covers all technologies that enable the surface properties of workpieces to be changed. It is important in this respect that the primary function of a workpiece in metalworking can be supplemented by surface treatment with additional functions. The principle of functional separation between the surface and the volume of a tool or component is the primary goal of this sheet metal processing manufacturing technique.

The volume of a workpiece has a specific function and certain characteristics such as machinability, strength, weight and so on. If a surface technology process is used in sheet metal processing, the workpiece or tool can be optimized in such a way that it fulfills a specific requirement profile and has a wide range of functions. These may include the following:

- Barrier function, thermal insulation, diffusion, permeation, corrosion resistance)
- Mechanical protection (friction, wear)
- Optical function (decoration, absorption, reflection)
- Functional integration (functional printing, printing process)
- Electrical function (electrical insulation, conductivity)

Different methods can be used to carry out a surface treatment in sheet metal processing. The surface treatments in metalworking are therefore allocated to different process classes, which are the following:

- Surface removal (electropolishing, burnishing)
- Surface coating (chrome plating, powder coating, painting)
- Mechanical surface treatment (shot peening, polishing, grinding)
- Chemical surface treatment (pickling, degreasing, cleaning)

SHEET METAL TOOLS:

The various operations such as cutting, shearing, bending, folding etc. are performed

by these tools.

1. Marking and measuring tools

a) Steel rule

b) Scriber

c) Divider

d) Try square

2.Cutting tools

a) Straight snip

b) Curved snip

3. Striking tools

a) Mallet

4. Supporting tools

a) Bench stake

b) Beak horn stake

c) Bevel edge square stake

d) Funnel stake

e) Pipe stake

f) Hatchet stake

5. Miscellaneous tools.

a) Nose pliers

b) Soldering iron

1. MARKING AND MEASURING TOOLS

STEEL RULE:

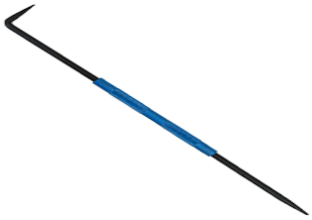
It is stiff, straight steel strip having all the faces machined true. On one of the flat faces, graduations are marked in inches and centimeters. The least count is 1mm.It is used to set out dimensions.

TRY SQUARE:

Try square is used for making and testing angles of 90degree. It consists of a steel blade, riveted into a hard wood stock which has a protective brass plate on the working surface. Another type is the all-metal square, with steel blade and cast iron stock. Sizes vary from 150 to 300mm,according to the length of the blade.

SCRIBER:

A scriber is a slender steel tool, used to scribe or mark lines on metal work pieces.



DIVIDER:

It has two straight legs sharpened at one end, hinged at other end. This is used for marking circles, arcs, laying out perpendicular lines, bisecting lines, etc.

2. CUTTING TOOLS:

STRAIGHT SNIP:

They have straight jaws and used for straight line cutting.

CURVED SNIP:

They have curved blades for making circular cuts.

3. STRIKNG TOOLS:

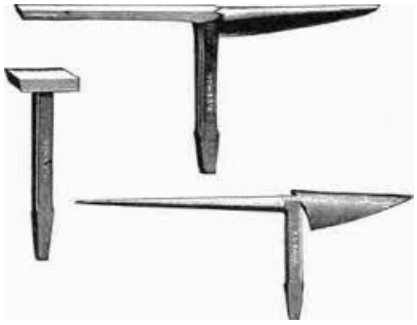
MALLET:

It is wooden-headed hammer of round or rectangular cross section. The striking face is made flat to the work. A mallet is used to give light blows to the Sheet metal in bending, finishing, cutting tools having wooden handle such as chisels.

4. SUPPORTING TOOLS:

BENCH STAKE:

It consists of an right angled mild steel piece fitted on the bench, used for bending at right angles.



BEAK HORN STAKE It has a round tapered h
square tapered horn on the opposite side. The
round tapered end used for bending of sheet
metal into cylinders and conical shapes etc. The
squared end of stake is used for bending and
truing straight-sided work.

BEVEL EDGE SQUARE STAKE: Used to form corners and edges.

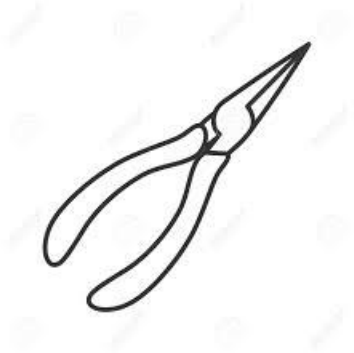
FUNNEL STAKE

It has tapered round working face it is used for shaping cone

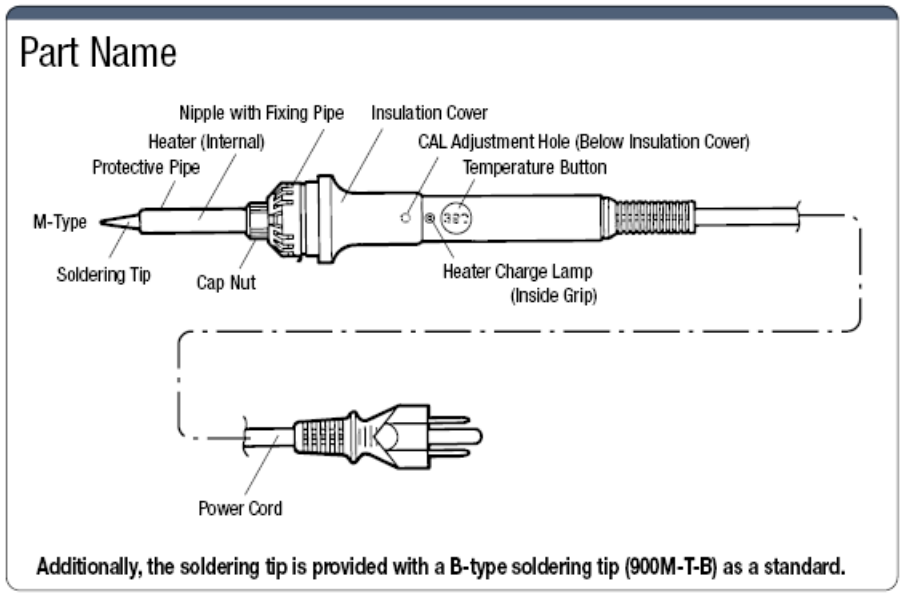
Pipe stake : it is used for hollow objects

MISCELLANEOUS TOOLS:

NOSE PLIER: It is made of tool steel, it is having serrations for gripping purpose, used for holding and bending of sheet metal.



SOLDERING IRON: It consists of forged piece of copper fastened to iron rod with a wooden handle on one end. It is used to join two pieces of metal by means of an alloy of tin and lead.



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EXPERIMENT 1
SQUARE TRAY

AIM: To make a square tray as per given dimensions

MATERIALS REQUIRED: G.I sheet of size 150 X 150mm .

TOOLS REQUIRED

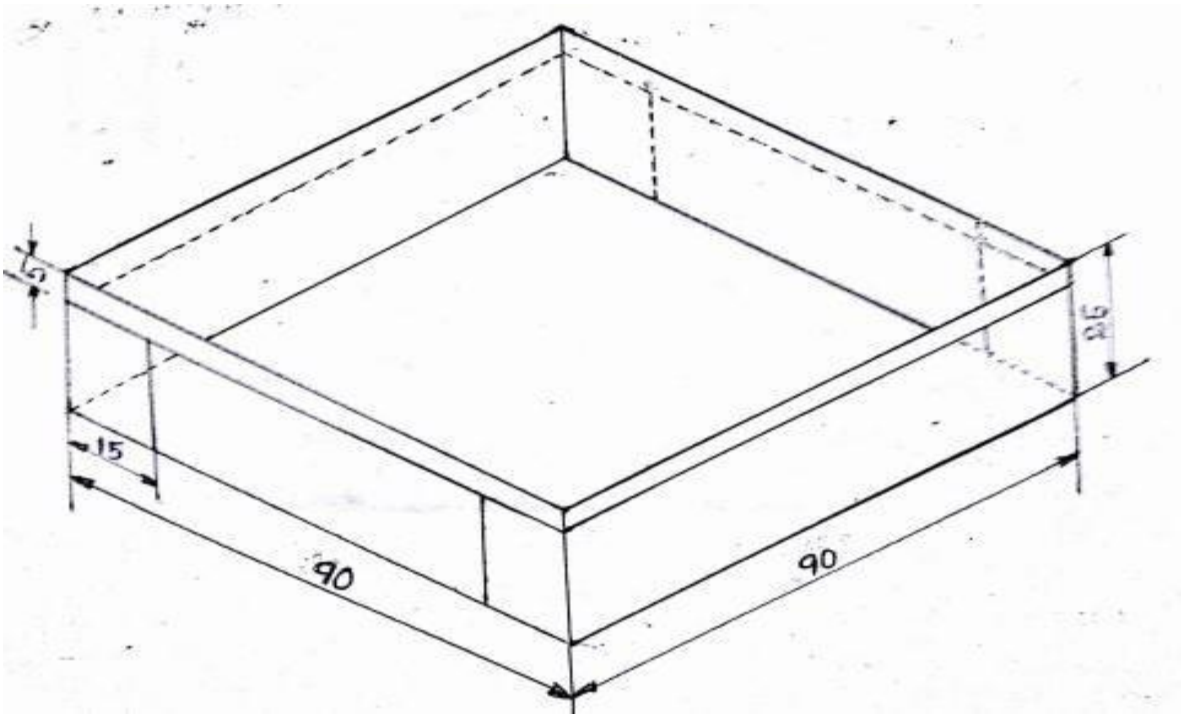
- Steel rule
- Mallet
- Scriber
- Straight snips
- Bench shear
- Try square
- Anvil

LIST OF OPERATIONS

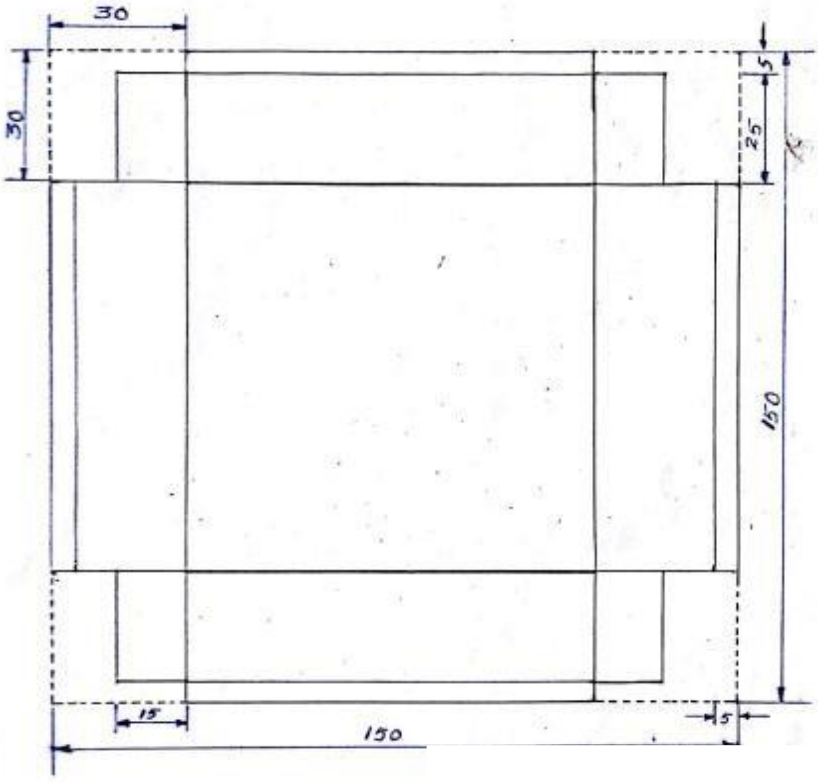
- Laying out and marking
- Cutting, Notch cutting
- Bending, Hemming
- Finishing

PROCEDURE

1. Copy the given drawing.
2. Collect the tools and sheet metal.
3. Draw the layout on the work material.
4. Cut the Sheet along the marked out line.
5. Check the edges of sheet for straightness and perpendicularity with the help of try square.
6. Mark all the necessary line to make the required model.
7. Cut the sheet along the lines with straight snips.
8. Do all the bending operations to get the square as vertical sides.
9. Bent all edges to avoid sharp corners and edges for safety.
10. Straighten the four sides and then finish the model.
11. Check all the dimensions and finish.



REQUIRED DIMENSIONS



RESULT: we were able to make a square tray of the given dimensions accurately

PRECAUTIONS:

- handle the equipments carefully as they may cause serious injury
- always wash your hand after working with metals in the shop
- Avoid running your hands over a sharp cut, even if you are wearing gloves.