

NORTHERN INDIA ENGINEERING COLLEGE

MANUFACTURING PROCESS LAB

SHEET METAL SHOP

EXPERIMENT NO.1

NAME OF EXPERIMENT: Study of tools and operations in sheet metal shop.

INTRODUCTION TO SHEET METAL

Metal used in sheet metal work

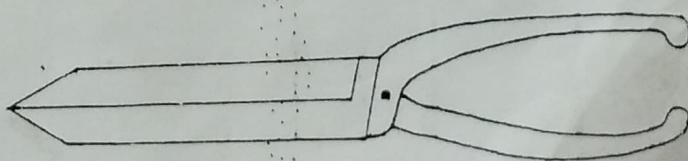
1. **Galvanized iron:** This is soft steel coated with zinc to resist corrosion and to improve its appearance. The zinc coating help to prevent oxidation. Galvanized iron is used for gutter work, furnace and air conditioners, ventilators, tanks, guards.
2. **Tin plate:** Tin plate is made by coating iron sheets with pure tin. Tin sheets are available in 1mm to 6mm. These are used in food containers, dairy equipments etc.
3. **Copper:** Copper sheet is high cost but it is used for long lasting roofing material and ducts that demand resistance to corrosion. The metal is easily fabricated because of its malleability.
4. **Aluminium:** It is a rust proof metal, light and has long wearing qualities. It is used for boats, flashing, roofing material as a house siding and other industrial products.
5. **Stainless steel:** It has a high percentage of chromium. It has a higher tensile strength and hardness than ordinary steel, therefore is harder to work. It has a good corrosion resistance. Stainless steel used for sink and other products that require strength, hardness, beauty and resistance to corrosion.

The term sheet metal implies metal and alloys in sheet rolled to thickness ranging from 10 swg and thinner. Plates are above to 10 swg thickness.

TOOLS USED IN SHEET METAL SHOP:

Cutting tools:

1. **Straight shear:** The main purpose of the shear is to cut the sheet along the lines scribed on it. The line may be straight line or curve. For cutting along straight lines, straight shear is used whose blades are straight.



straight Snip

Marking tools:

Marking tools are used to mark the sheet according to required dimensions. Various marking tools are:

1. **Steel rule:** These are available in variety of sizes. The rule could be steel foot rule, folding rule or tape rule.
2. **Steel square:** It is a L-shaped piece of hardened steel. It is used to make square corners. It is also used for checking and making right angles.
3. **Scriber:** It is used to mark lines on metallic sheets. It is made up of hardened steel.
4. **Divider:** It is used for scribing arcs and circles on the metallic sheets. It is also made up of hardened steel. One leg is rested at indentation point and the other leg is used to scribe arc and circles.

Punches:

The following type of punch made of tool steel are commonly used for sheet metal work:

1. **Prick punch:** These punches are used for making small dents or indentations marks for locating the center position for divider or trammel points. The punches have tapered point grounded to 30° included angles.
2. **Center punch:** These are used for marking the location of points and center of holes to be drilled. Its taper point is grounded to 90° included angles.
3. **Dot punch:** It is used for making dotted lines. It is made up of high carbon steel or high-speed steel. One end is sharpened. Hammering is done on the second end while working. Its taper point is grounded to 60° included angles.

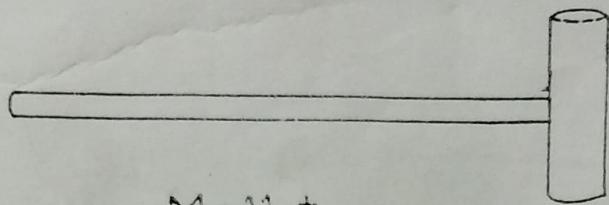
Striking and Supporting tools:

The hammers are used in sheet metal shop for bending of sheets, flattening of sheets, riveting works, to give hollow or curved shape, for locking seam joints etc. For these operations, the following hammers are generally used:

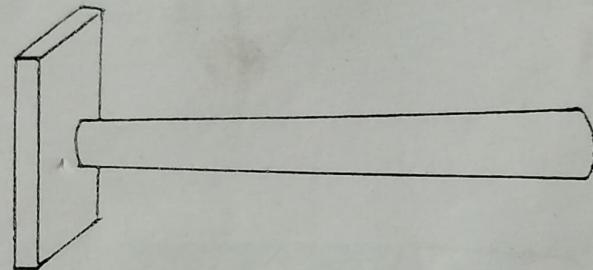
1. **Mallet :** This is the most used hammer in any sheet metal shop. These are made of good quality hard wood, plastic, hard fibre. These are used whenever working on soft metal.
2. **Square face hammers:** This hammer is also called setting hammer and has a square flat face. It is used for flattening the seams without damaging the metal sheet.

Stakes:

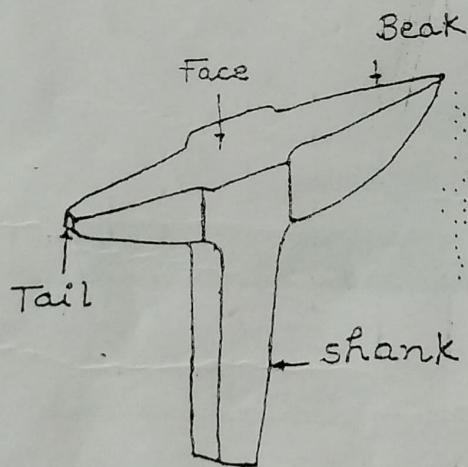
Stakes are supporting tools without which nearly most of the basic operations such as bending, seaming, forming , riveting , punching etc. cannot be carried out. They are fitted in wood and jobs are worked upon them.



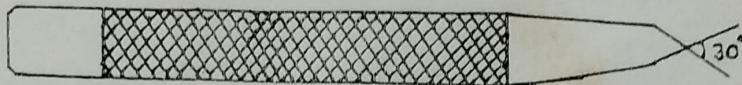
Mallet



Square face hammer



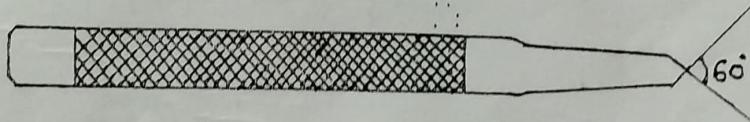
Bick Iron



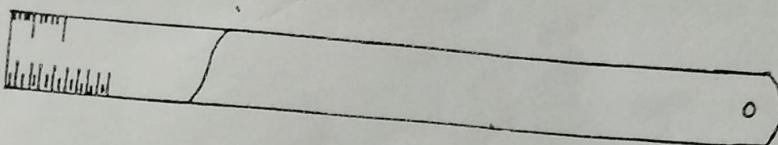
Prick Punch



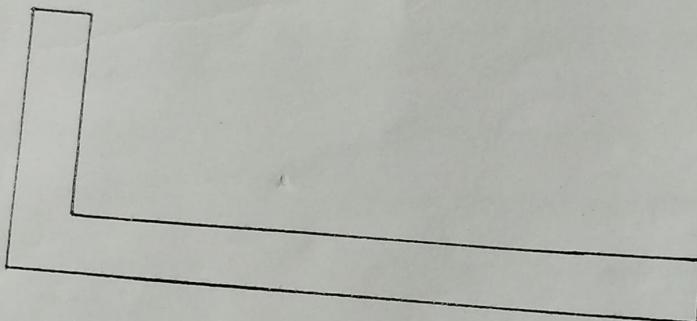
Center Punch



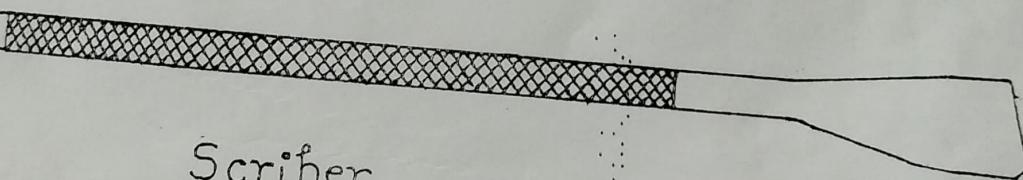
Dot Punch



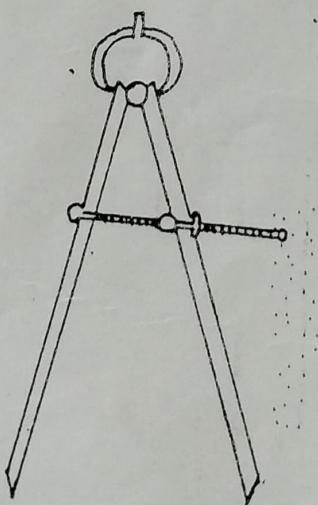
Steel Foot Rule



Steel Square



Scriber



Divider

SHEET METAL SHOP OPERATIONS:

1. *Measuring and Marking:* The standard market sized of metal sheet are quite large. So, for marking articles, the required dimension are measured and marked on the sheet.
2. *Cutting off:* This means severing a piece from a strip with a cut along single line.
3. *Parting:* Parting signifies that scrap is removed between the two pieces to part them.
4. *Laying out:* Scribing the development of the surface of the article on the sheet.
5. *Notching:* It is a process of removing metal to the desired shape from the side or edge of a sheet or strip.
6. *Lancing:* This makes a cut part away across a strip.
7. *Trimming:* It is an operation of cutting away excess metal in a flash from a piece.
8. *Hand forming:* Folding and bending of sheet in three dimensions to get required articles.
9. *Soldering:* Soldering is a process of joining two similar metals by using another low temperature alloy. The metal used for the joining purpose is called solder.

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Experiment No.2

Object:-

To make a rectangular tray with the help of given G.I.sheet metal piece.

Material Required:-

The material to be used for making rectangular tray is G.I. sheet of 28 swg thickness, the size of the sheet as per development (shown in figure) is 170mmx150 mm.

Tools Required:-

1. straight shear (Snip)
2. Scriber
3. Try square
4. wood mallet
5. Bick Iron
6. Steel Rule(foot rule)
7. Smooth file
8. Standard wire gauge (S.W.G.)
9. Anvil
10. Bench vice

Development of sheet metal component:-

When the complete surface is open out and laid on plane, the surface of the solid has 'developed' and the figure obtained is called development, is the true length of the corresponding line on the surface. are normally developed with the inside face up.

The knowledge of development of surfaces is frequently required in the design and manufacturing of an object, practical applications of developments occur in sheet metal work, pattern making etc.

Notching is used to cut away a portion of the metal to prevent overlapping and bulging on seams and edges. The *notching* is done on the blanks or patterns prior to forming process.

Procedure:-

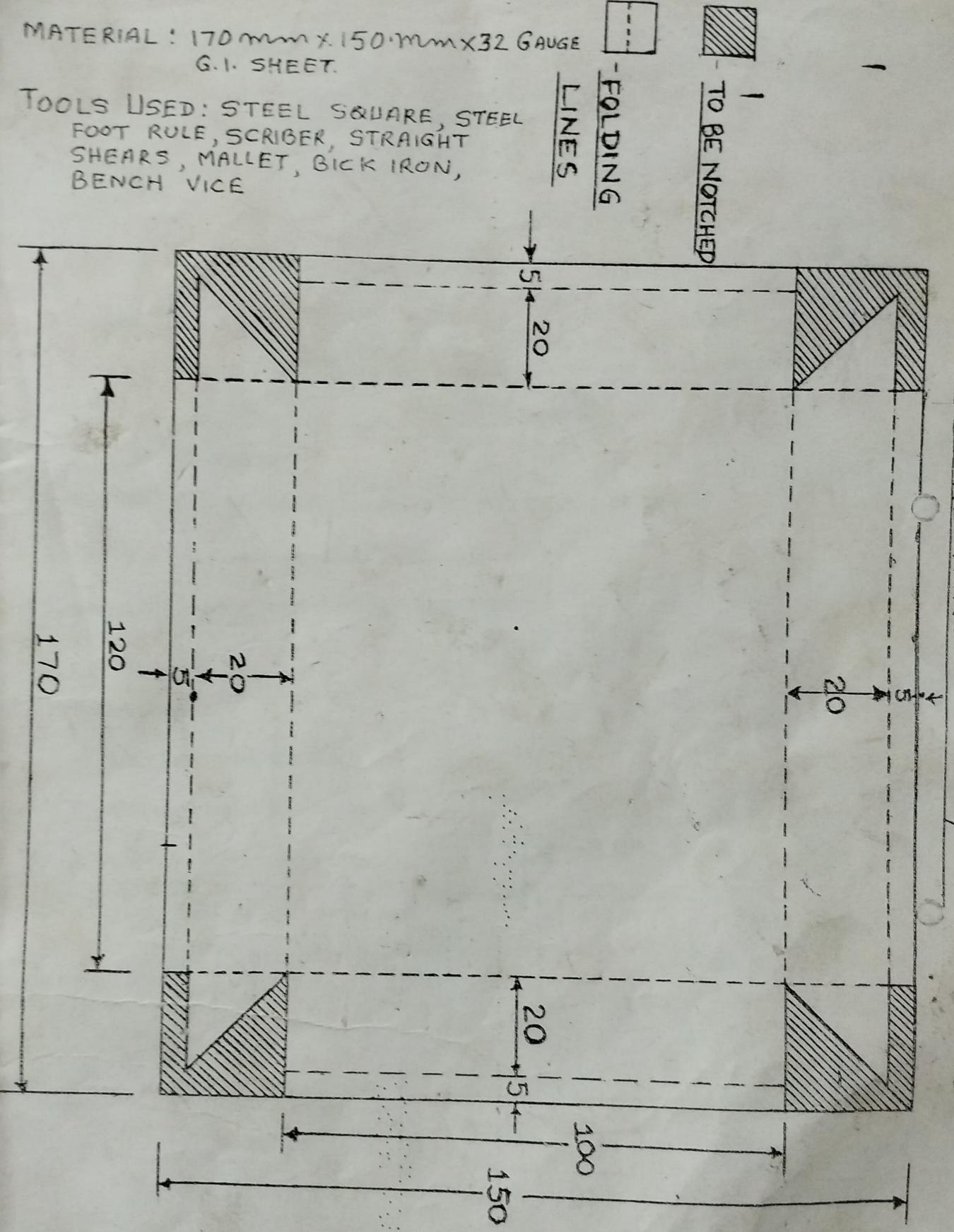
1. Draw the development of the tray as shown in figure.
2. Cut a piece (blank) of size 170mmx150mm from 28swg thickness G.I. sheet.
3. Mark the folding lines & portion to be notched on the blank. Notch out the portion with a straight shear.
4. Make the plain head on the blank.
5. Bend the overlapping portions.
6. Fold the blank to *form* the tray.
7. Finish the job to the required shape & size.

Precautions

1. Perform the operations as per sequences given in the procedure.
2. Use stakes of proper size to give good shapes to the job.
3. Protect your hands from sharp corners of edges of the sheet.
4. Don't allow any scratch mark to come on the sheet surface

MATERIAL: 170 mm x 150 mm x 32 GAUGE
G.I. SHEET.

TOOLS USED: STEEL SQUARE, STEEL
FOOT RULE, SCRIBER, STRAIGHT
SHEARS, MALLET, BICK IRON,
BENCH VICE



EXPERIMENT NO. 4

OBJECT : To make a single V shape Butt joint with the given piece of mild steel by using arc welding.

EQUIPMENTS : A.C. Welding set air / oil cooled transformer.

TOOLS USED : (1) Electrode Holder

- (2) Earthing Clamp
- (3) Hand Screen
- (4) Hand Gloves, Apron & Leather Shoes
- (5) Wire Brush
- (6) Tongs
- (7) Chipping Hammer
- (8) Chipping Goggles
- (9) Welding Table etc.

MATERIAL REQUIRED : Two mild steel pieces of given size $60 \times 50 \times 5$ mm

Electrode – 3.15mm ø

Welding position – D/H (Down Hand)

Current required – 90 to 120 Amp.

PROCEDURE :

- (1) Cut the work pieces according to the given dimensions.
- (2) To make the pieces V shaped, first punch the piece its width side 1 mm and then punch it at 30° from the punching line. Similarly the second piece is also been punched. So the including angle both the pieces is 60° and then the punching lines are filed. Hence the V shape is made.
- (3) Start the welding machine and set the current 90 to 120 amp.
- (4) Connect earthing clamp to the base plate and keep the job on the base plate.
- (5) Put electrode in the electrode holder.
- (6) Now ~~both~~ both the pieces are kept in front providing the gap of 1mm between to avoid distortion and to get good penetration and fusion in the pieces.

- (7) Now put the tag on the upper and lower side of the pieces and one tag on the opposite side of the pieces at the centre to stop the distortion. Then the welding bead is made from V shape side, top to bottom.
- (8) Chip off the slag by chipping hammer and clean the joint by wire brush.

RESULT : A proper V shape Butt joint has been achieved / made.

PRECAUTIONS :

- (1) Never look at the arc by naked eyes. Use the welding screen or goggles.
- (2) Always wear the safety hand gloves, apron & leather shoes.
- (3) Never chip slag while it is hot, without wearing chipping goggles.
- (4) Avoid use of damaged tools.
- (5) Always use tong for holding the heated job.

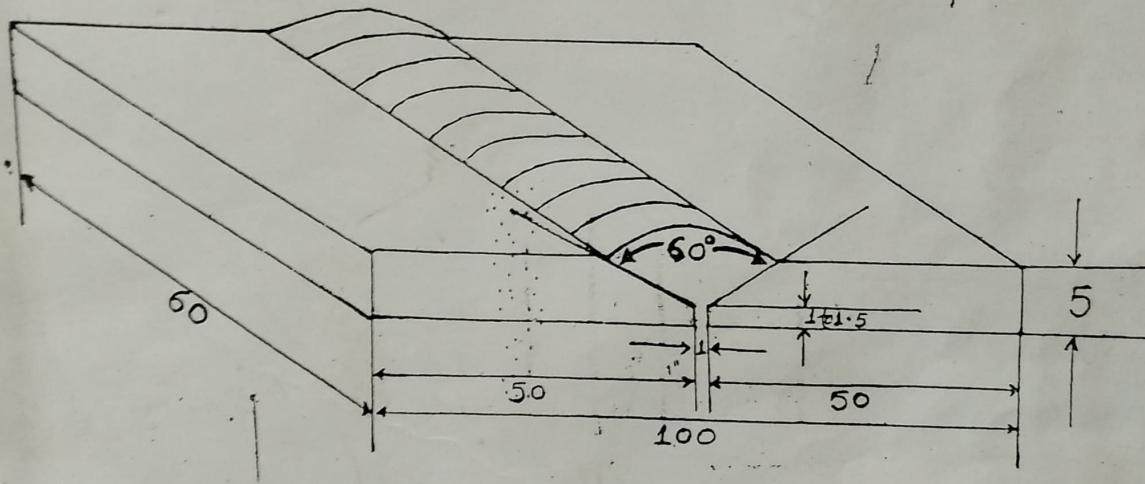


FIGURE : BUTT JOINT(V SHAPE)

ALL DIMENSIONS ARE IN M.M.
M.S. PIECE SIZE - 60×50×5 M.M.
Ø OF ELECTRODE - 3.15 M.M.
WELDING POSITION - D/H

ELECTRIC ARC WELDING :- Electric arc welding is the process by which welding is done by producing heat from an electric arc, between the work and electrode. Heat generated in an arc welding is in the range of 3600°C to 4000°C . Both A.C. as well as D.C. is used in producing an arc, each having its particular applications.

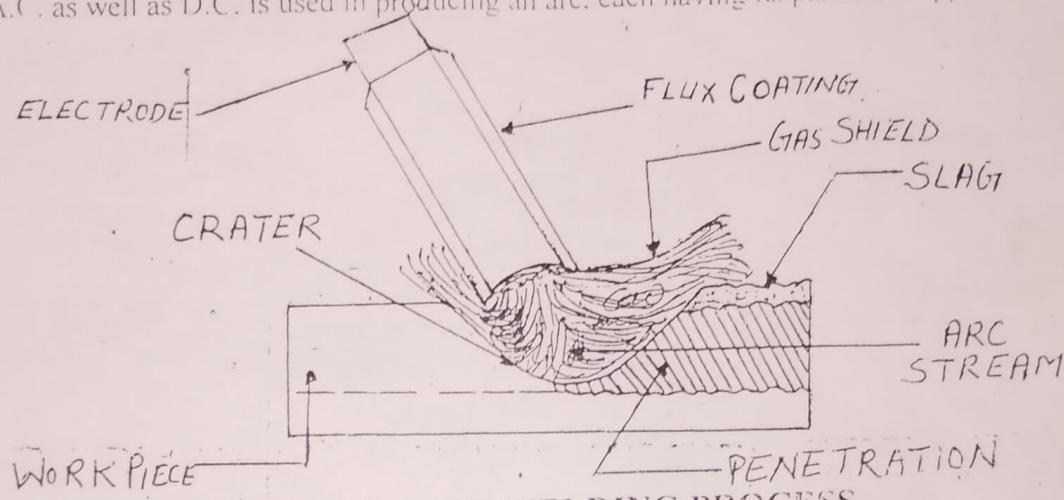


FIGURE : ARC WELDING PROCESS

EQUIPMENT AND TOOLS USED FOR METAL ARC WELDING

(1) ARC WELDING EQUIPMENT : Both alternating current (A.C.) and direct current (D.C.) are used for arc welding, when D.C. arc is to be employed the current is generated by a D.C. generator. This generator can be given by means of an electric motor or by means of a petrol or diesel engine.

For A.C. arc welding a step-down transformer is used which receives current from the supply mains at 400 – 440 volts and transforms it to the required voltage for welding i.e. 80 – 100 volts.

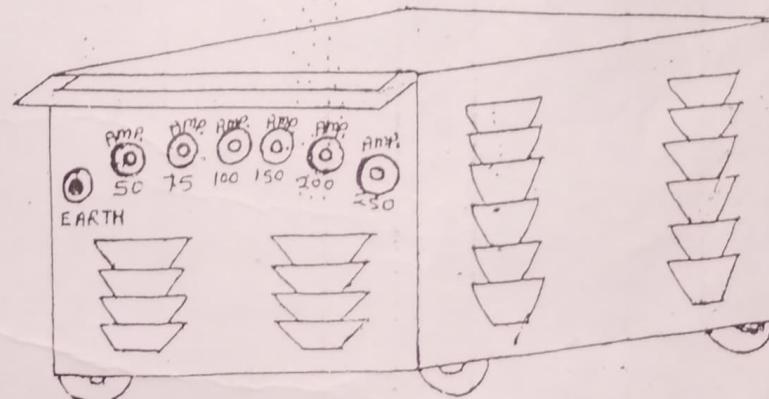


FIGURE : A.C. WELDING TRANSFORMER (AIR COOLED)

(2) FACE SHIELD / HAND SCREEN: When arc is produced around the job, infrared rays and ultraviolet rays are produced. To protect the face and eyes from these dangerous rays, a shield is necessary.

The body of a shield is made of fiber glass and coloured glasses are used to see the arc. The coloured glasses of different shades are available for welding and cutting. Shade no. 10 is used for metal arc welding and 14 for Plasma cutting.

(3) HAND GLOVES, APRON AND LEATHER SHOES : The hand gloves, apron and leather shoes are used to protect hands, cloths and foot, while welding. These are made of leather or asbestos material.

(4) CABLES OR LEADS: These leads are made up of copper or aluminum wire. The wires are insulated with rubber and cloth fiber. A heavy insulation is necessary for these cables.

(5) ELECTRODE HOLDER : It is connected to electrode lead and is used to hold the metallic electrode during metal arc welding. It should be light in weight, balanced, insulated except jaws, heat resistant and easy to receive and eject the electrode.

(6) CLEANING TOOLS : Chipping hammer and wire brushes are used to clean the weld area & to remove the slag and spatter. The chipping hammer is generally double ended, having a point at one end and a flat chisel shape at the other.

(7) CHIPPING GOGGLES : This is wearied to protect eyes from slag during chipping process.

(8) TONG : It is made of forge steel and is used to hold the work piece.

(9) ELECTRODE : Electrodes are of two types.

(I) COATED ELECTRODES :- Coated electrodes are generally applied in arc welding processes. Metallic core is coated with some suitable material. The material used for core are mild steel, nickel steel, chromium, molybdenum steel etc. One end of the coated core is kept bare for holding.

(II) BARE ELECTRODE :- Bare electrode produce the welding of poor quality. These are cheaper than coated electrodes. These are generally used in modern welding process like M.F.G. Welding.

(11) FIRE EXTINGUISHERS :- Fire extinguishers are used to prevent the fire that may break out of chance. Sand filled baskets and closed cylinders are kept ready to meet such accidents.

(5) TORCH TIPS :- For different types of job, different types of tips are used. The size of the tip is specified by the outlet hole diameter. More than one hole are also provided in tips. The tip is screwed or fitted on the front end of the torch.

(6) HOSE PIPE :- IT is generally used as a passage to draw the oxygen and acetylene gases from the respective cylinders. It is re-enforced to withstand the high pressures of gases.

Green or black hose pipe is used for oxygen gas and red or maroon hose pipe is used for acetylene gas.

(7) GOGGLES :- Gas flames produce high intensity light & heat rays, which are harmful to naked eyes. To protect the eyes from these rays, goggles are used. Goggles also protect the eyes from flying sparks.

(8) SPARK LIGHTER :- For starting the flame, the spark should be given by a spark lighter. Matchsticks should not be used, as there is risk of burning hand.

(9) FILLER :- The rod which provides additional metal in completing the welding is known as filler. The composition of filler metal should be the same as that of the metals to be welded.

(10) FLUX :- The chemicals which deoxidize the metal surface and provide inert atmosphere around the molten metal are known as fluxes. Fluxes are available as liquid, powder, paste and gas.

(11) FIRE EXTINGUISHERS :- Fire extinguishers are used to prevent the fire that may break out of chance. Sand filled baskets and closed cylinders are kept ready to meet such accidents.