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WELDING SHOP

WELDING

It is a material joining process which process produces coalescence of materials by heating them to suitable temperatures with or without the application of pressure alone.

→ Welding is used for making permanent joints.

→ It is used in the manufacture of automobile bodies, aircraft frames, railway wagons, machine frames, structural works, tanks, furniture, boilers, general repair work and ship building.

TYPES

• Plastic Welding or Pressure Welding

The piece of metal to be joined are heated to a plastic state and forced together by external pressure.

Ex - Resistance welding

• Fusion Welding or Pressure Welding

The material at the joint is heated to a molten state and allowed to solidify.

Ex - Gas welding, Arc welding

CLASSIFICATION OF WELDING PROCESS

i) Arc Welding

- Carbon arc
- Metal arc
- Metal inert gas
- Tungsten inert gas
- Plasma arc
- Submerged arc
- Electro-slag

ii) Gas Welding

- Oxy-acetylene
- Air-acetylene
- Oxy-hydrogen

iii) Resistance Welding

- Butt
- Spot
- Seam
- Projection
- Percussion

iv) Thermit Welding

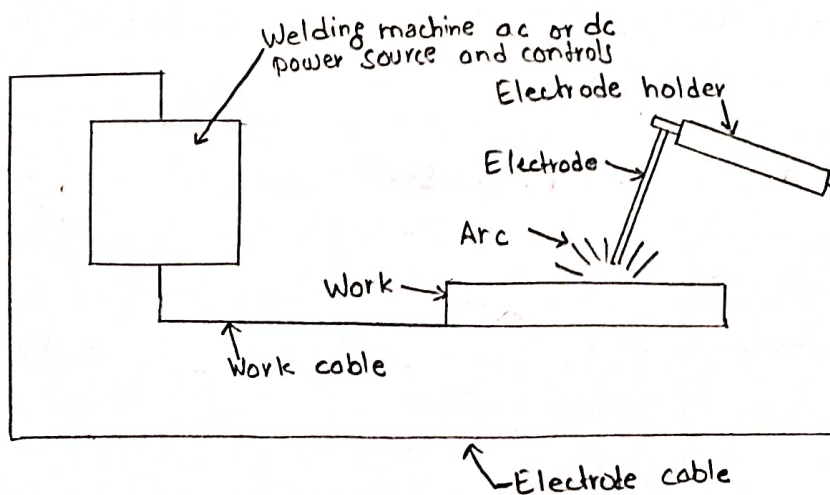
v) Solid State Welding

- friction
- diffusion
- ultrasonic
- explosive

vi) Arc Welding

→ Equipment

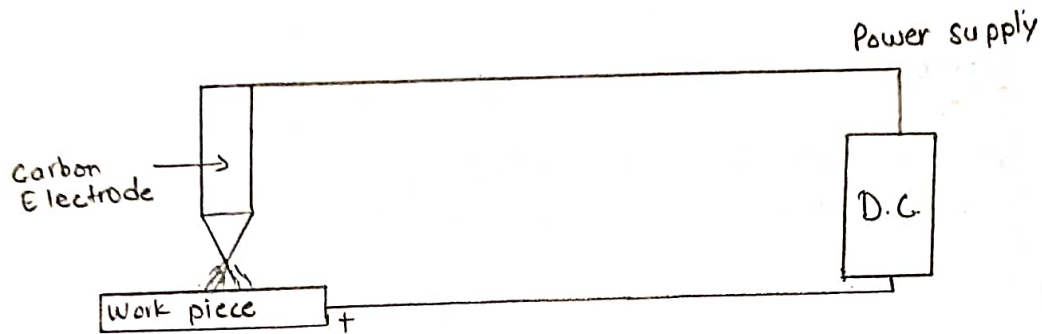
- a welding generation (D.C.) or transformer (A.C.)
- two cables - one for work and one for electrodes
- electrode holder
- electrode
- Protective shield
- Gloves
- Wire brush
- Chipping hammer
- Goggles



Arc Welding

Uses an electric arc to coalesce metals. Arc welding is the most common method of welding metals. Electricity travels from electrode to base metal to ground.

Carbon Arc Welding



Carbon Arc Welding

Advantages

Arc Welding

- Most efficient way to join metals
- Lowest-cost joining method
- Affords lighter weight through better utilization of materials
- Joins all commercial metals
- Provides design flexibility

Limitations

- Manually applied, therefore high labour cost
- Need high energy causing danger
- Not convenient for disassembly.
- Defects are hard to detect at joints
-

Comparison of A.C. and D.C. arc welding

→ Alternating Current (from Transformer)

- More efficiency
- Power consumption less
- Cost of equipment is less
- Higher voltage - hence not safe.
- Not preferred for welding thin sections.

→ Direct Current

- Less efficiency
- Power consumption more
- Cost of equipment is more
- Low voltage - safer operation
- preferred for welding thin sections

GAS WELDING

- Sound weld is obtained by selecting proper size of flame, filler material and method of moving torch.
- Temperature generated during the process is 3300°C .
- When the metal is fused, oxygen from the atmosphere and the torch combines with molten metal and forms oxides, results defective weld.
- Fluxes are added to the welded metal to remove oxides

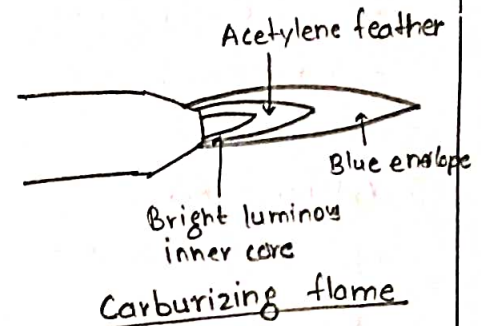
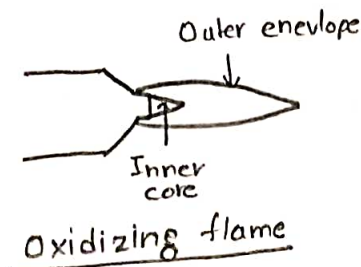
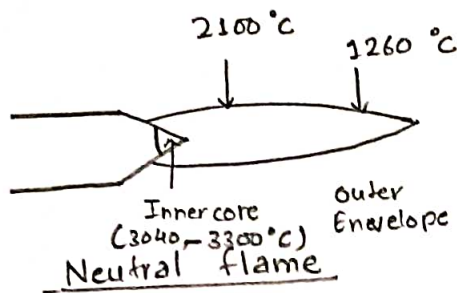
Gas Welding Equipment

- i) Gas cylinders
- ii) Regulators
- iii) Pressure Gauges
- iv) Hoses
- v) Welding torch
- vi) Check valve
- vii) Non return valve

Types of flames

- Oxygen is turned on, flame immediately changes into a long white inner area (Feather) surrounded by a transparent blue envelope is called Carburizing flame (3000°C)
- Addition of little more oxygen give a bright whitish cone surrounded by the transparent blue envelope is called Neutral flame (It has a balance of fl fuels gas and oxygen) (3200°C)
- Used for welding steels, aluminium, copper and cast iron.

- If more oxygen is added, the cone becomes darker and more pointed, while the envelope becomes shorter and more fierce is called Oxidizing flame.



GAS CUTTING

- Ferrous metal is heated into red hot condition and a jet of pure oxygen is projected onto the surface, which rapidly oxidizes.
- Oxygen having lower melting point than the metal, melt and are blown away by the force of the jet, to make a cut.
- Fast and efficient method of cutting steel to a high degree of accuracy.
- Torch is different from welding
- Cutting torch has preheat orifice and one central orifice for oxygen jet.

Piercing - Used to cut a hole at the centre of the plate or away from the edge of the plate.

Gouging - to cut a groove into the steel surface.

Brazing and Soldering

• Brazing

It is a low temperature joining process. It is performed at temperatures above 840° F and it generally affords strengths comparable to those of the metal which it joins. It is low temperature in that it is done below the melting point of the base metal. It is

achieved by diffusion without fusion (melting) of the base.

→ Classification

- Torch brazing
- Dip brazing
- Furnace brazing
- Induction brazing

→ Advantages

- Dissimilar metals which cannot be welded can be joined by brazing.
- Very thin metals can be joined.
- Metals with different thickness can be joined easily.

→ Disadvantages

- Brazed joints have lesser strength compared to welding.
- Joint preparation cost is more.
- Can be used for thin sheet metal sections.

• Soldering

→ It is a low temperature joining process.

It is performed at temperatures below 840°F for joining.

→ Soldering is used for,

- Sealing, as an automotive radiators or tin cans.
- Electrical connections
- Joining thermally sensitive components
- Joining dissimilar metals.

Arc Welding Electrodes.

Electrodes commonly used are generally of two types -

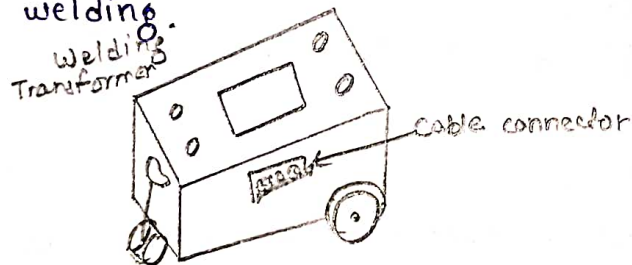
- bare
- coated

The factors which influence the selection of particular electrode for metal arc welding can be -

- i) availability of current AC or DC
- ii) composition of base metal.
- iii) thickness of base metal.
- iv) welding position
- v) amount of penetration required in welding
- vi) fit up the component to be welded.

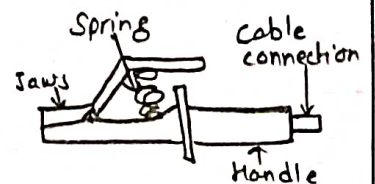
Equipments and Tools

- i) Transformer - This type of welding machine produces AC current and is considered to be least expensive. It takes power supply from a supply line and transform it to the voltage required for welding.



- ii) Motor Generators - These are D.C. Generators in which electric motor and alternator are mounted on same shaft to produce D.C. power as per requirement for welding.

- iii) Electrode holder - The electrode holder is connected to the end of the welding cable and hold the electrode. The jaws of the holder are insulated offering protection.



- iv) Ground Clamp - It is connected to the end of the ground cable is clamped to the work. It should be strong and durable and give a low resistance connection.

v> Wire Brush and Chipping hammer - A wire brush is used for cleaning and preparing the work of welding.

vi> Face shield - It is used to protect eyes and face from the rays of arc from spatter. It is available either in hand or helmet type.

Welding joints -

- Welding position

→ There are five recognised position for welding

- + flat or down hand position

- + Vertical position

- + inclined position

- + over head position

- + horizontal position

Advantages of arc welding

→ Welding process is simple

→ equipment is portable and the cost is fairly low.

Gas Welding

Oxy-acetylene flame is commonly used for gas welding. It consists of the supply of oxygen and acetylene under pressure in cylinder.

Model No.

→ Straight beads

→ Butt beads

→ Fillet joints

AIM

To make a butt joint on the given mild steel flat piece in down hand position by arc welding.

MATERIALS REQUIRED

Work piece - Mild steel flat of size $123 \times 30 \times 6$ mm - 2 no.

Electrodes - Mild steel electrodes 10 SWG (3.2 mm) - 1 no.

TOOLS REQUIRED

Steel rule, Try Square, Scribber, Hackshaw, Bench vice, flat file, face shield, Tongs, wire-brush, chipping hammer, Welding machine and all other arc welding accessories.

LIST OF OPERATIONS

Measuring, Marking, Fixing, Cutting, Filing, Welding, Deslagging, Cleaning and inspecting.

PROCEDURE

- 1> Copy the given drawing in the work record.
- 2> Cut the work piece as per the drawing.
- 3> File the work piece to the dimensional accuracy.
- 4> Kept the work piece on the welding table in the down hand position.
- 5> Set the ampere of the machine and use protective cloth, select suitable electrode and proper shield.
- 6> Tack welds the two ends of the work piece and checks the alignment.
- 7> Remove the slag and spatters using the chipping hammer and wire brush.
- 8> After completion of weld, the weld bead should be inspected.

