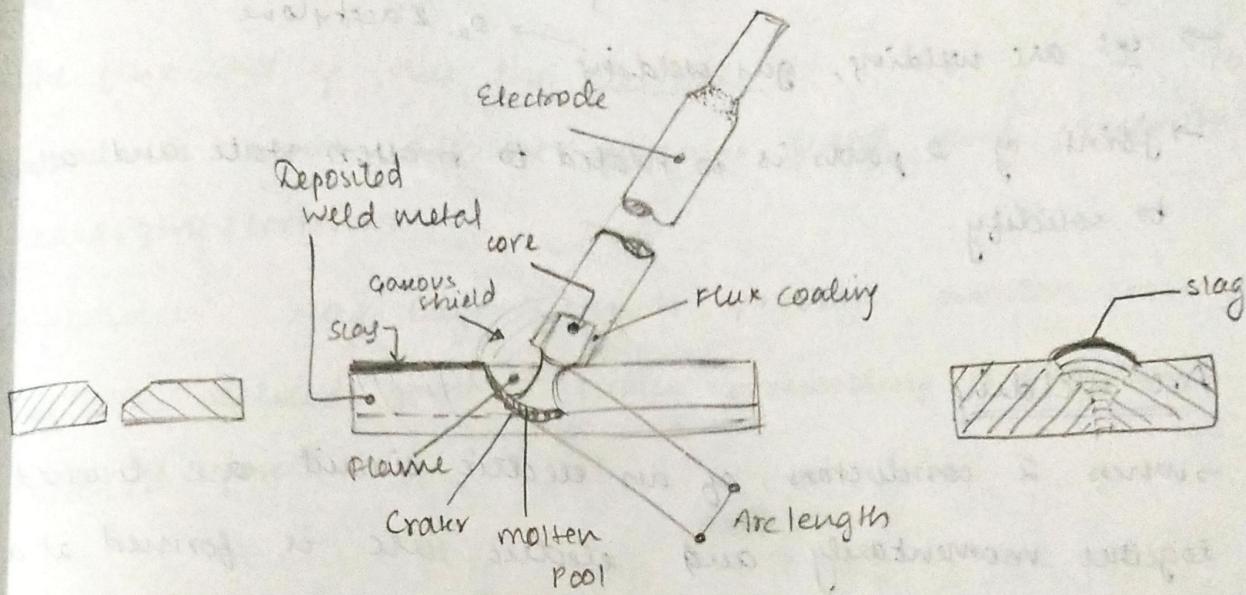


ARC Weldingmetal-jointing process:welding:

The metallurgical joining of 2 parts metal pieces together to produce essentially a single piece of metal.

Types:

- 1) Pressure-welding: The parts to be joined by heating up to plastic state and then fused by external pressure.

Forge welding

Resistance

2) Fusion:

- aka non-pressure welding
- arc welding, gas welding → O_2 & acetylene
- joint of 2 parts is heated to molten state and allowed to solidify.

Arc welding:

- when 2 conductors of an electric circuit are touched together momentarily and electric arc is formed at a temperature of $5000 - 6000^\circ C$.
- the electrode (welding rod) is connected to the negative part of the circuit & the workpiece becomes the +ve part of the circuit.
- when the arc is formed, the intense heat quickly melts the workpiece metal which is directly under the arc forming a small molten metal pool.
- At the same time, the tip of the electrode at the arc also melts and this molten metal of the electrode is carried over by the ^{arc} ~~work~~ to the molten metal pool of the workplace.
- The molten metal in the pool is agitated ^{by} the action of the arc thoroughly mixing the base (workpiece metal) and filler metal (electrode material).

- A solid joint will be formed, when the molten metal cools and solidifies.
- The flux coating over the electrode
 - produces inner a inert gaseous field and prevents oxidizing / corrosion.
 - produces slag layer - which prevents sudden cooling of the welded joint & hence preventing a weaker welded joint.

Arc welding Machine:

- AC Arc welding machine in which a step-down transformer is used which receives AC supply between 200-440 V and transforms it to the required voltage of 80-100 V. A high current of 100-400 A will be suitable for general arc welding purposes.

DC arc welding machine: ~~one~~ in which electrode is connected to the -ve part of the ckt & positive is connected to the positive part of the circuit. In order to melt greater mass of the product, in the base of the P material. This kind of setup is said to have straight polarity. When the less heat is ^{req.} at base material, the polarity is reversed.

Because of choosing of polarity it's possible to melt many metals which requires more heat to melt.

* As the AC current acquires 0 values twice in every cycle, at these moments, $PD = 0$ and hence higher voltage is required to maintain the arc.

Types of Arc welding Electrodes

1) consumable electrodes: also melts along with the workpiece & ^{fills} ~~fixes~~ the joint. They are made of various metals depending upon the purpose and chem. comp. of the work forces.
ex-welding

2) Non-consumable electrode: they are used with an additional filler material like ~~to~~ and in this type of electrode, the amount of metal deposited by the pillar rod can be controlled.

ex: soldering

Q. List the purpose of each ingredient of flux coating?

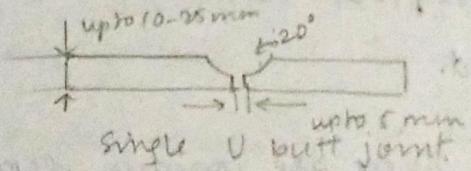
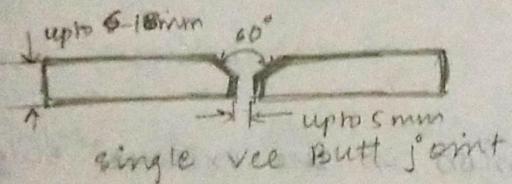
safety devices used in Arc welding

- The welding shield protects the eyes from IR & UV rad.
- Gloves are used to protect hands from sparks & to insulate from elec. shocks.
- Chipping hammer & wire brush to clear the slag.
- Apron to protect clothing from sparks & spatter.
- Earthing clamp will avoid risk of electric shock.

general welding procedure :

step 1: cleaning: The surfaces of the parts to be welded need to be thoroughly cleaned for removal of dirt, oil, grease, etc.

Step 2: edge Preparation: It is required to join the metals properly and to get a stronger welded joint.



Step 3: clamping: The parts to be welded are clamped suitably through jigs and fixtures so that ^{there} are no undesirable movements during welding.

Step 4: check for safety equipments : like goggles, shield, aprons, etc.

Step 5: The initial weld: It's done at opp. ends of the joint to secure the pieces together.

Step 6: Intermediate and final welding: weld joint is formed through various weaving movements.

Step 7: Excess material removal: its removed using tongs and chisel.

Welding Defects

- 1) Cracking: occurs due to incorrect electrodes or wrong working procedures. cracked welds must be cut out & re-welded.
- 2) incorrect edge preparation: too narrow an angle of the edges of the workpieces results in poor fusion, slag inclusions and weak weld.
- 3) craters: These are concave depression in the external surface of the welded joints which reduces the volume of the weld and thus the strength of the joint.
- 4) Under-cutting: it is excess melting of the parent metal which reduces its strength.
- 5) Porous weld: insufficient gap b/w electrode & workpiece results in slag inclusion & porous welds.
- 6) over welding: welding over an already welded layer \rightarrow overheat earlier layer resulting in no proper fusion b/w 2 layers.

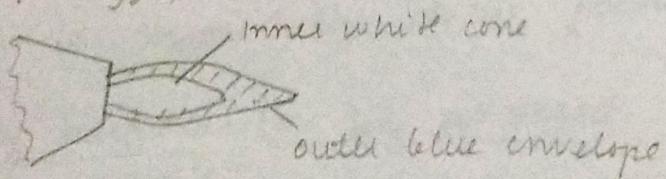
8. Art merits & demerits of welding

9. Applications of welding.

Gas welding:

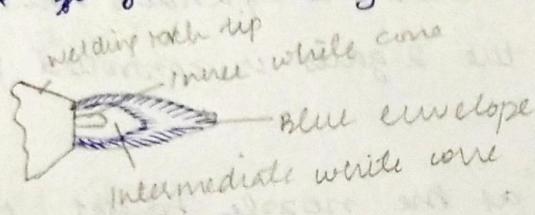
- It is a fusion method of welding in which O_2 and acetylene gases are used to get a flame around $3200^\circ C$.
- In this type of welding, we have one O_2 cylinder, one acetylene cylinder. These 2 cylinders have flexible hoses & the pressure of the 2 gases is controlled by pressure regulators.
- The 2 gases are mixed at the nozzle to get the oxy-acetylene flame.
- A neutral flame is obtained by supplying equal volumes of oxygen & acetylene (1:1).
- A neutral flame consists of an inner small whitish cone surrounded by a sharply defined blue flame.
- Most of the oxy-acetylene welding is done with neutral flame.

welding torch
dip (nozzle)



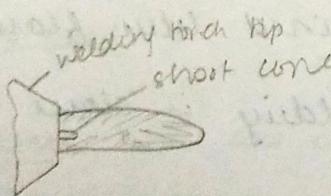
Carburizing Flame

- aka reducing flame is obtained by supplying excess acetylene. (O_2 : acetylene = 0.95:1)
- It has 3 cones: inner white cone, surrounded by intermediate white cone & a bluish envelope flame.
- Used for ~~welding~~ alloy steels, cast irons and Al to protect from oxidizable elements.



Oxidizing Flame

- obtained when there's excess O_2 . (O_2 : acetylene = 1.5:1)
- It has a shorter white cone.
- Used for monel metal, nickel & many non-ferrous metals.



Soldering

- It is a method of igniting 2 thin metal pieces using a dissimilar metal or an alloy by the application of heat.
- The alloy of lead and tin called soft solder is used for sheet metal work, plumbing work and electrical junctions.
- The solder will be at the temp. of 150-350°C.
- To prevent oxidation, soldering flux like ZnCl_2 , rosin, borax is used.
- An alloy of Cu, Sn and Ag known as hard solder is used for stronger joints.
- The soldering temp. ranges from 600-900°C.

Method of Soldering

- 1) Cleaning of joining surfaces: The parts to be joined are mechanically and electrically cleaned to remove any dust, oil or grease.
- 2) Application of flux: The joining surfaces are coated with flux to chemically clean joint surfaces.
- 3) Tinning of surfaces to be soldered: Before carrying out the solder operation, the soldering iron must be tinned to remove thin films of oxide that forms on the Cu bit. In tinning the Cu bit, it is heated

then rubbed with a file to clean it properly and flux is applied for chemical cleaning. This whole process is called tinning.

- 4) Heating: the soldering iron is then heated and the flowing ^(soldering wire) molten filler metal fills the joint interface
- 5) Final Clean-up: The soldered joints are cleaned to remove excess deposited soldering wire material to prevent short-circuits within the

Q. List adv & disadv of

1) arc welding 2) soldering 3) gas welding

Q. List & discuss appl. of

1) arc welding 2) soldering 3) gas welding

Q. Diff b/w arc welding & gas welding