

Electric welding

Welding is a process of joining 2 pieces of metal by the application of heat with (or) without pressure & filler metal.

- Adv.
- (i) uniform weld., strong joints
 - (ii) saving time & cost
 - (iii) less consumption of material
 - (iv) simple operation
 - (v) can joint critical parts (ultrasonic, laser)

- Types - Gas welding
- oxy-acetylene
 - acetylene
 - oxy-hydrogen.
 - Resistance
 - Arc
 - Solid state
 - Newer:
 - electron beam
 - Laser.

- Solid state - is 4 types
- a) Friction
 - b) ultrasonic
 - c) diffusion
 - d) explosive
- Resistance ^{welding-heating} types
- a) butt
 - Flash
 - upset
 - b) spot
 - c) seam
 - d) Projection

- Arc welding.
- Carbon Arc
 - metal arc
 - Hydrogen arc.
 - Metal inert gas
 - Tungsten inert gas

Resistance welding	Arc.
(i) only Arc	(i) (AC + DC)
(ii) Pressure is used about (450 mega Pascal)	(ii) Pressure X
(iii) low voltage	(iii) High voltage
(iv) used for mass production	(iv) ^{is} used for repair work
(v) better P.F. compared to Arc	(v) P.F. Very low.

(vi) Non consumable electrode

(vii) consumable electrode

Resistance welding (2nd losses)

2 electrodes - consumable electrode,
non consumable electrode.

Properties of electrode

→ Hardness

→ Conductivity

eg. (Cu + Cr) Hence alloy of Cu is selected

* generally electrodes used for ^{Resistance welding} electric
is non consumable.

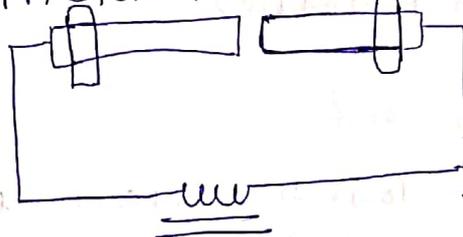
(1) Cu-Cr - is used to weld mild steel, (low strength steel)

(2) Cu-Cd - is used to weld non ferrous metal
(Al, Mg).

Butt welding

Fixed clamp

moveable clamp



→ AC supply

→ step down transformer is used.



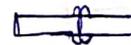
Butt welding

up set (1 stage process)

flash (2 stage process)

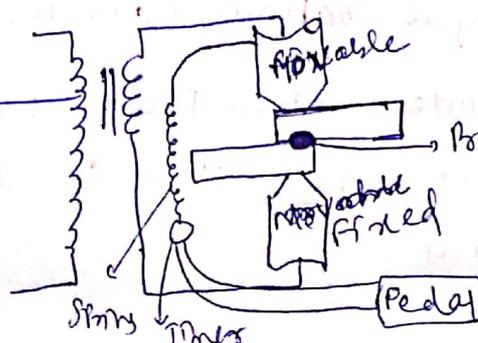
spark * 1st current is supplied
then pressure

* 2 to 10V, min (50 amp. - low A)



(fix) (removable one)

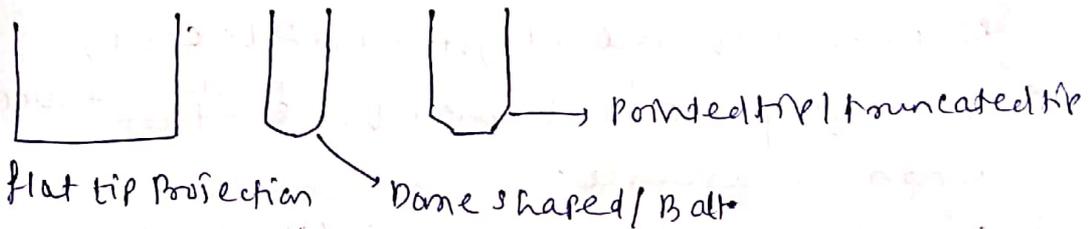
(2) Spot welding



Pressure is applied
in the particular
area for welding

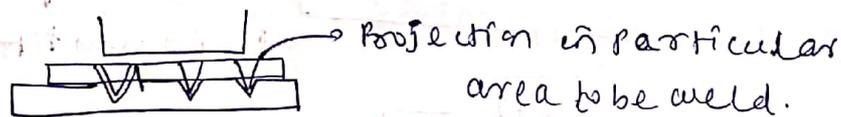
- Spang-Cadmium-Bronze
- electrode - Cu/bronze
- magnitude of current & duration of current depends upon (thickness + composition of plate).
- current range - 600 A to 1200 A applied for fraction of second to some second.

(3) * Spot welding

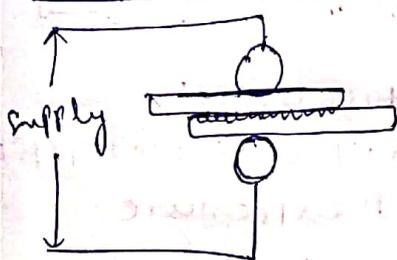


- * If you want to weld non-ferrous metal then dome shaped electrodes are used.
- * for ferrous metal - Pointed tip / truncated tip. (chances of damage in pointed tip)

(3)* Projection welding



(1) Seam welding



- * Area to be welded in continuation.
- * Continuous spot welding / chain welding

- * (3mm) - thickness of the component should be.
- * supply maybe continuous or in the form of pulse
- * current interruption phenomena is used.
- * welding speed depends upon speed of wheel.
1 to 5 m/min

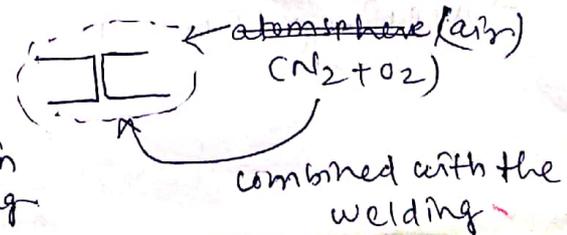
S.No	Types of Resistance welding	Application
1	Butt welding	For welding rods, tubes, wires.
2	Flash butt welding	for welding tubing, bars, rods forgings, fittings & automotive & air products, refrigerators, welding band <u>saw blades</u>
3	Spot welding	for welding components made from plates (10mm to 12mm in thickness) for fabricating (or) forming sheet metal structure
4	Projection welding	used for mass production work eg. welding of refrigerator, condensers, crossed-wire welding, refrigerator racks, grill
5	Seam welding	Used for welding of pipes, conduits tanks, gasoline tanks, refrigerators various types of containers.

Arc welding

- Arc ^{is} developed - tremendous amount of heat is developed.
- Temp → 3000°C to 20,000°C (general temp min = 3600°C)
- Arc length - (0.5 to 1.1) d. → dia of the electrode
- electrode -
 - Consumable (coated / fluxed electrodes)
 - non-consumable (bare electrode) - no coating
 - ⇒ C, G, Tungsten
 - (DC supply) → Both work for (AC/DC)

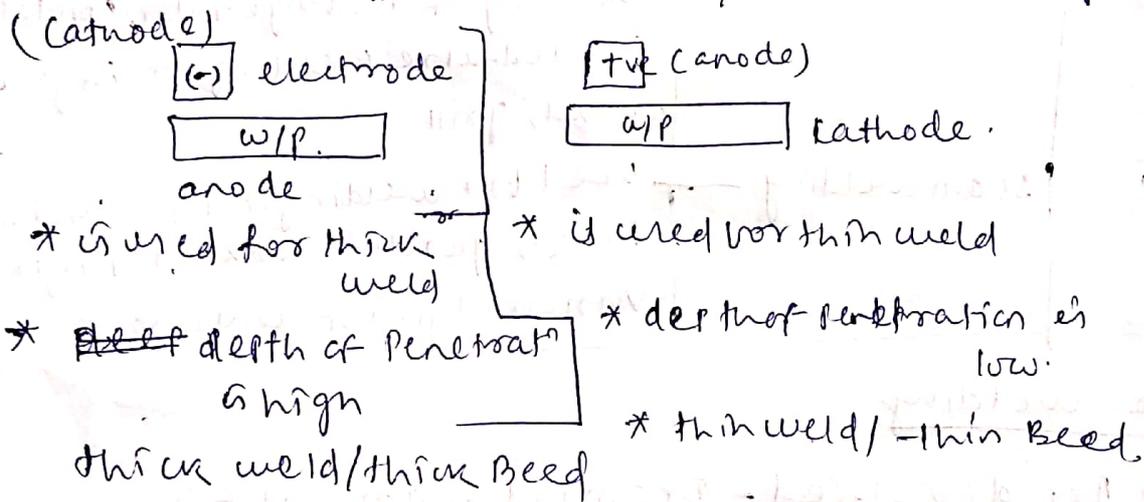
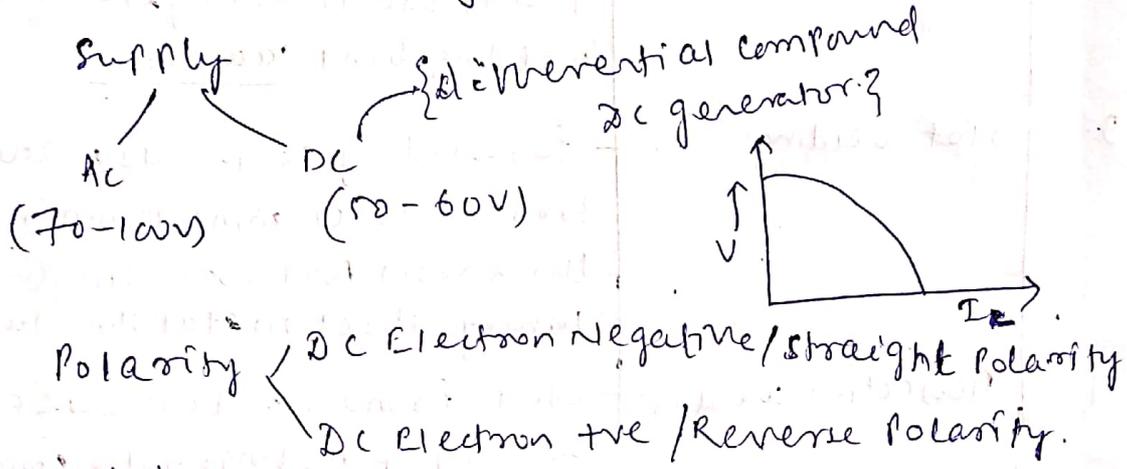
Bare / Non consumable

air-oxidation - crack in welding



* Coated - consumable
 the layer is melted which creates ^{alloy of} CO and acts as a protective shield. (slag).

- Oxidation (X)
- Salt of Ca, Si, Mg. is used

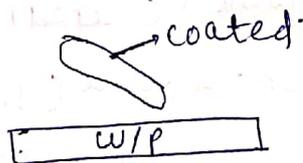


Carbon Arc welding (Non-consumable electrode)

- * Filters used
- * Polarity is not constant (choice not preferred)

Metal Arc welding

→ straight Polarity

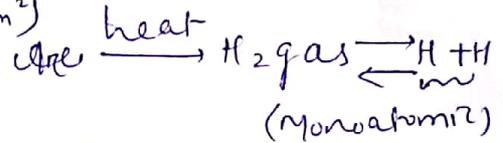
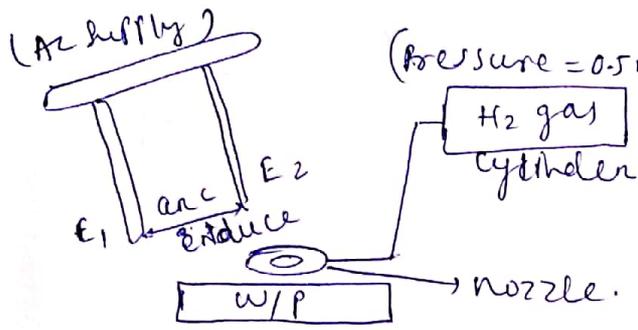


→ Consumable electrode

→ Appⁿ → ^{for} repair work

3) Hydrogen Arc welding:-

→ 2 electrodes are used, electrode is of Tungsten.



When the monoatomic Hydrogen atom is again converted to H_2 it produces large amount of heat. & that heat is given to the W/P through nozzle.

Application

Fusion of
for Ferrous alloy
Ni- or steel, Al in
repairing arc.

(4) Tungsten inert gas welding

- electrode - Tungsten (non consumable)
- use of filler rod.
- argon gas is used.
- If Helium as inert gas is used it can be known as He-Ar welding.

Application - bicycle industry, space vehicle,

(5) IG → in the shape of wire.

* supply is controlled by servomechanism of timer