

Presentation on Arc Welding

1

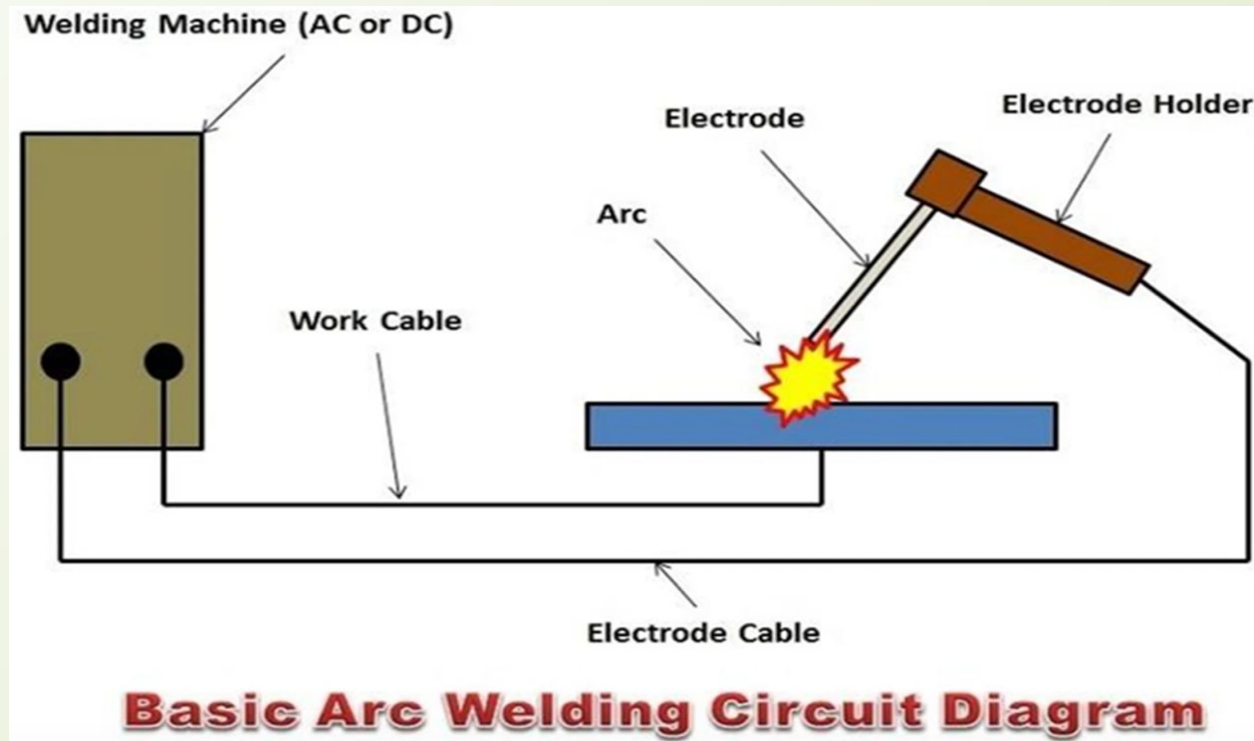
Submitted by:- Bibisha Shrestha

Ayush Kr. Sah

Bal Krishna Dhakal

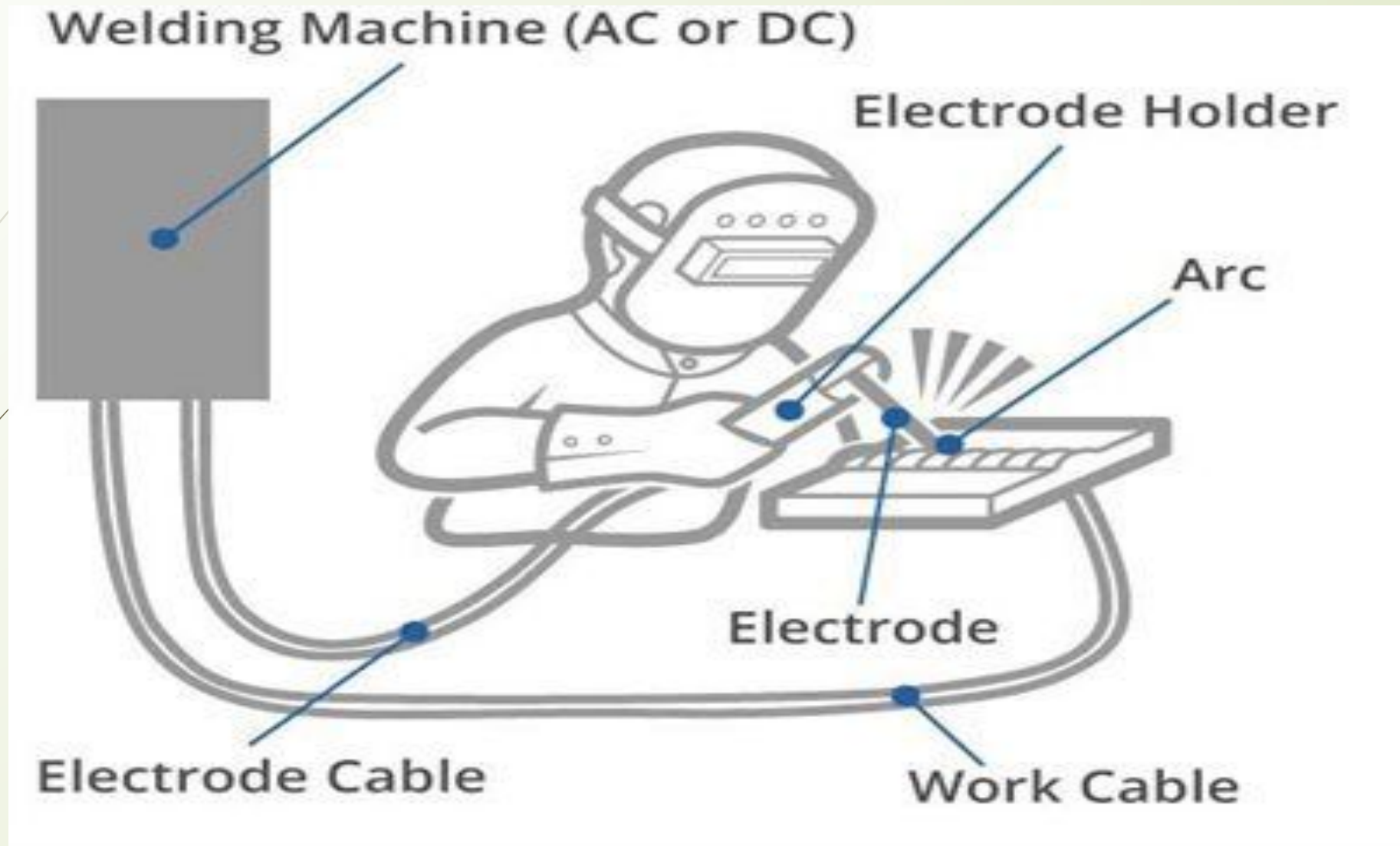
Barsha Gyawali

Arc welding



Welding

- ❑ Welding is a fabrication process whereby two or more parts like metals or thermoplastics are fused together by means of heat, pressure or both.
- ❑ Welding is distinct from lower temperature techniques such as brazing and soldering, which do not melt the base metal (parent metal).
- ❑ The completed welded joint may be referred to as a weldment.
- ❑ Weldability is defined as the capacity of a metal to be welded under the fabrication conditions.



Arc welding

- Arc welding is process using a welding power supply to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point.
- They can use either direct current (DC) or alternating current (AC), and consumable or non-consumable electrodes.
- The welding region is sometimes protected by some type of inert or semi-inert gas, known as a shielding gas, and filler material is sometimes used as well.

Equipment and accessories required

Equipment required:

1. Arc welding machines
2. Electrodes and filler metals
3. Electrode holder
4. Welding cables and connectors
5. Wire brush
6. Chipping hammer
7. Welding tongs
8. Ground clamp
9. Welding table

Accessories required:

1. Welding Helmets/face mask
2. Apron
3. Welding gloves

Equipment required:

❑ 1. Arc Welding Machines

- ❑ The cornerstone of any arc welding setup is the welding machine itself. These machines are responsible for generating the electrical current needed to create the welding arc.



2. Electrodes and filler metals

Electrodes and filler metals are essential components for arc welding. Electrodes are consumable rods or wires that provide the material to be deposited into the weld joint.

Filler metals are used to fill gaps and reinforce the weld.



3. Electrode holder

It is used to hold the electrode safely while welding.



4. Welding Cables and connectors

Welding machines require cables and connectors to transmit electrical current from the machine to the electrode holder and ground clamp.



5. Wire Brush

Wire Brush: A wire brush with stainless steel or brass bristles is used to clean the surface of the weld and surrounding area.



6. Chipping Hammer

Chipping hammers have a pointed end for removing slag and a chisel end for chipping away unwanted weld material.



7. Welding Tongs

Welding tongs can be used to hold small pieces of metal together during tack welding.



8. Ground Clamp

The ground clamp connects the workpiece to the welding machine's ground, completing the electrical circuit.



9. Welding Table or Workbench

Having a stable and well-designed welding table or workbench is essential for a clean and efficient welding setup.

Flat Surface: A flat surface ensures that your workpieces remain level and in the correct alignment during welding.

Clamping and Fixturing Options: Many welding tables come with built-in clamping and fixturing systems, making it easier to secure workpieces in place.

Heat Resistance: Welding tables are typically made from materials that can withstand high heat without warping or damage.

Accessories required:

1. Welding helmets/face mask

Welding helmets/mask are designed to keep your eyes and face safe from intense light and spark while providing clear visibility of your work.



2. Apron

Welding aprons protect workers from sparks, spatter, slag, and flame. They are made from leather, cotton, or composite materials that resist burning and melting.

3. Fire Extinguisher

Have a fire extinguisher on hand in case of welding-related fires.



4. First Aid Kit

A well-stocked first aid kit is essential for treating minor injuries and burns.










Electric Arc Welding:

- Electric Arc welding is a type of welding process using an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct (DC) or alternating (AC) currents.

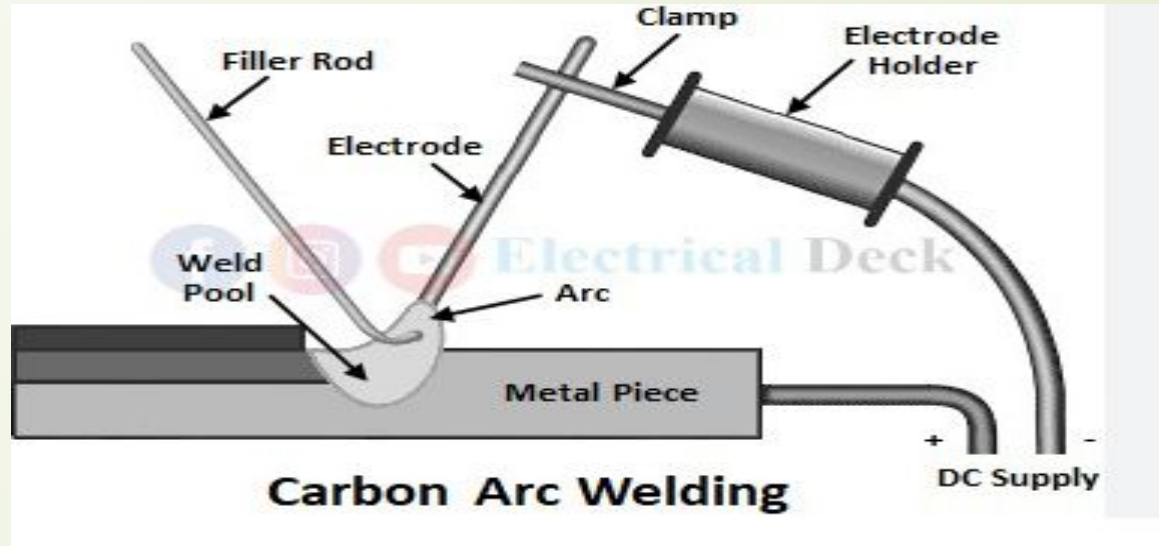




Types of Electric Arc Welding:

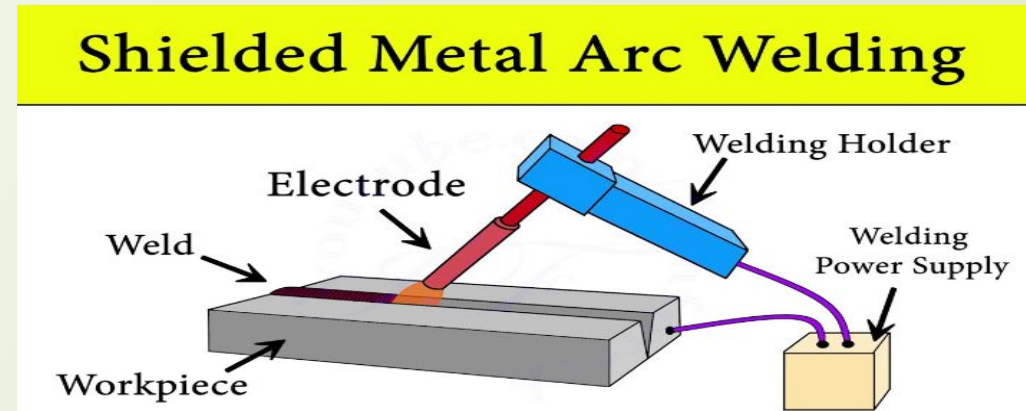
-  **1. Carbon arc welding**
 -  **2. Shielded metal arc welding**
 -  **3. Tungsten inert gas welding(TIG)**
 -  **4. Metal inert gas arc welding(MIG)**
 -  **5. Atomic hydrogen Welding**
 -  **6. Sub-merged arc welding**
- 

1. Carbon Arc Welding:



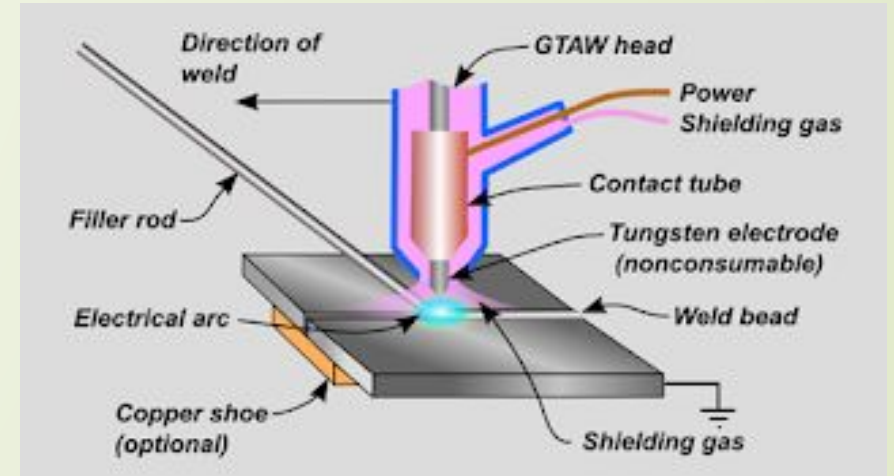
- ❑ In carbon-arc welding a carbon electrode is used to produce an electric arc between the electrode and the materials being bonded. This arc produces temperatures in excess of $3,000^{\circ}\text{C}$. At this temperature the separate metals form a bond and become welded together.

2. Shielded Metal Arc Welding:



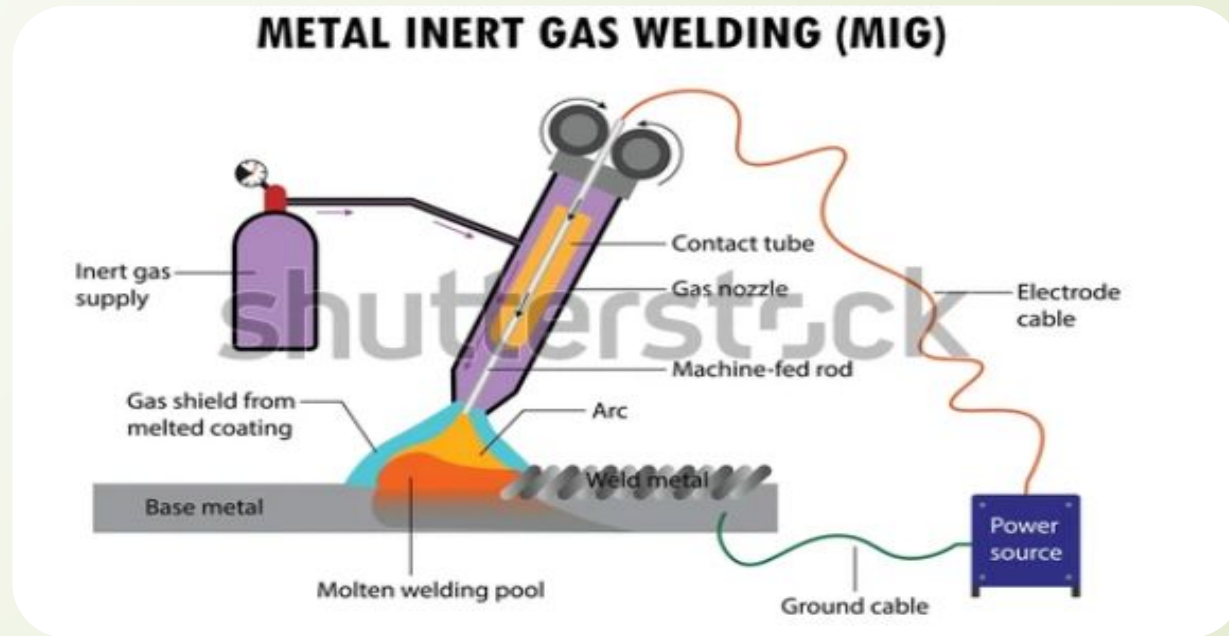
- Shielded metal arc welding is an electric arc welding process that joins metals together using a consumable electrode. It is commonly known as stick welding, remains to be one of the most commonly used welding techniques nowadays.

3. Tungsten Inert Gas Welding(TIG):



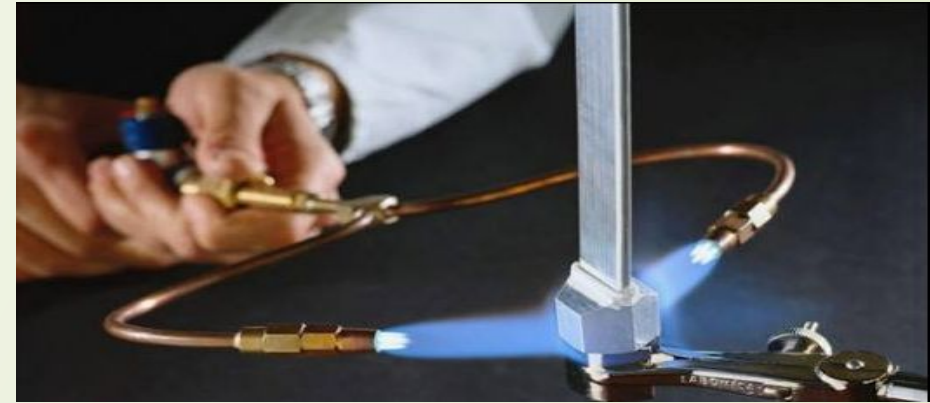
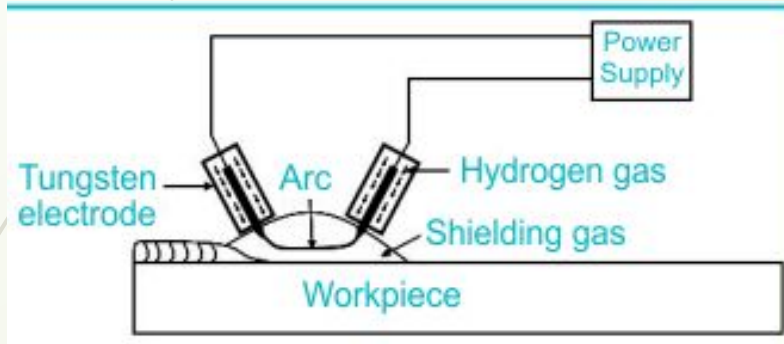
- ➔ Tungsten Inert Gas (TIG) welding, also known as Gas Tungsten Arc Welding (GTAW) is an arc welding process that produces the weld with a non-consumable tungsten electrode. TIG welders can be used to weld steel, stainless steel, chromoly, aluminum, nickel alloys, magnesium, copper, brass, bronze, and even gold.

4. Metal Inert Gas Welding(MIG):



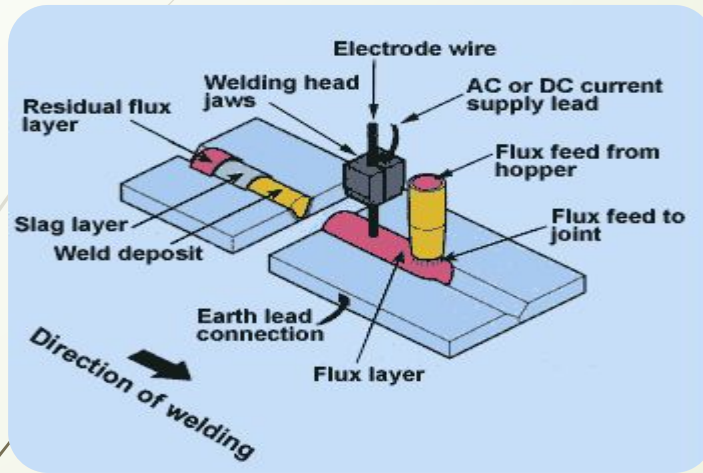
- ❑ MIG (Metal Inert Gas) welding is the process that uses inert gases or gas mixtures as the shielding gas. Argon and helium mixes are inert gases and typically used for the MIG welding of non-ferrous metals such as aluminium.

5. Atomic Hydrogen Welding:



- ➔ Atomic hydrogen welding (AHW or Athydo) is an arc welding process that uses an arc between two tungsten electrodes in a shielding atmosphere of hydrogen. It is commonly used for welding thick sections efficiently.

6.Sub-merged Arc Welding:



- Submerged Arc Welding (SAW) is a joining process that involves the formation of an electric arc between a continuously fed electrode and the workpiece to be welded. This type of welding is suitable for both indoor and outdoor works.

Factors affecting on Welding:

- ❑ 1.Type of metal
- ❑ 2.Thermal Conductivity
- ❑ 3.Surface Conditions
- ❑ 4.Coefficient of Thermal expansion
- ❑ 5.Reactivity
- ❑ 6.Electrical resistance

1.Type of metal: Different metals have different properties and require different welding techniques.

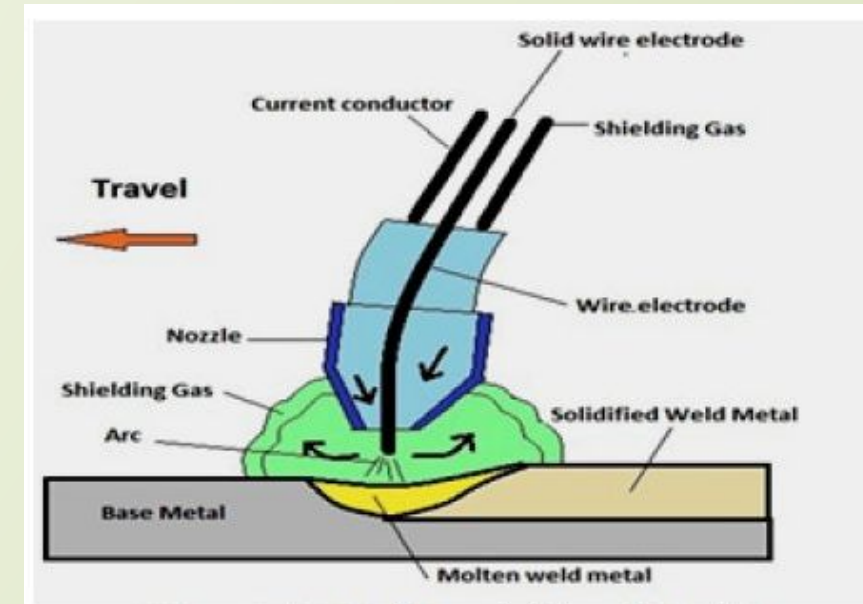
2.Thermal Conductivity : Thermal conductivity (K) of the material is indirectly proportional to weld ability . If K is more weld ability is less & vice versa.

3.Surface Conditions: Materials with oily surface, grease makes it difficult to weld.

4.Coefficient of Thermal expansion: Metals should not deform more due to high heat generation during welding , metals with high thermal expansion coefficient are not preferred for welding.

5.Reactivity: If the material reacts with air, water or surroundings it become difficult to weld.

6.Electrical resistance: Low & medium electrical resistance metals are preferred for welding.

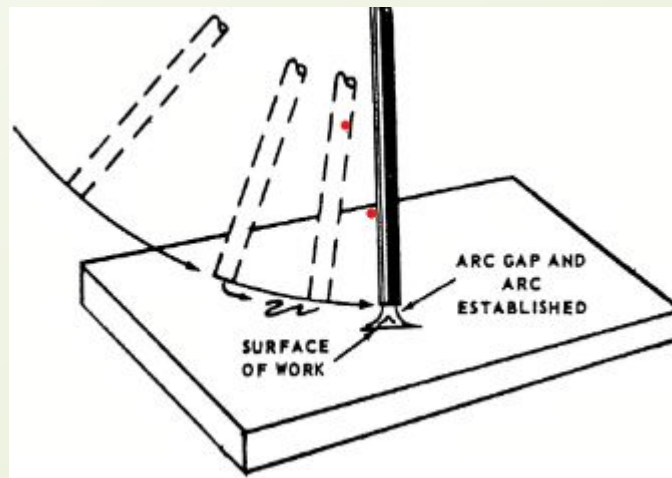


Methods of Striking the Arc:

25

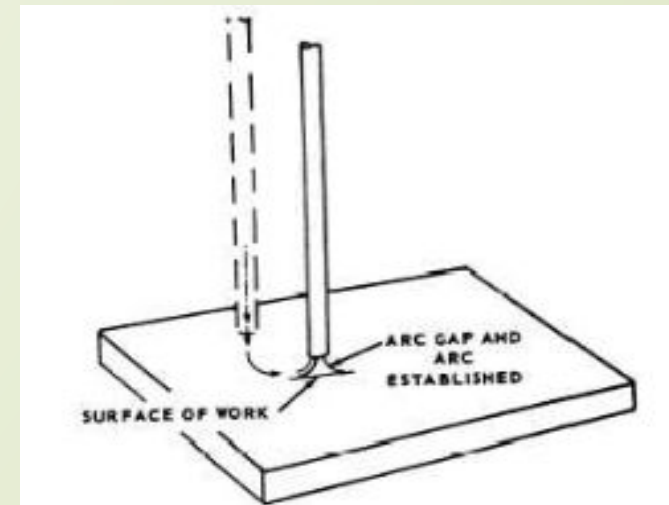
❑ Scratching:-

Scratching method is that which is done by scratching the electrode to the base metal just like scratching the match.



❑ Tapping:-

Tapping method is done by moving the electrode downward just like tapping the base metal.

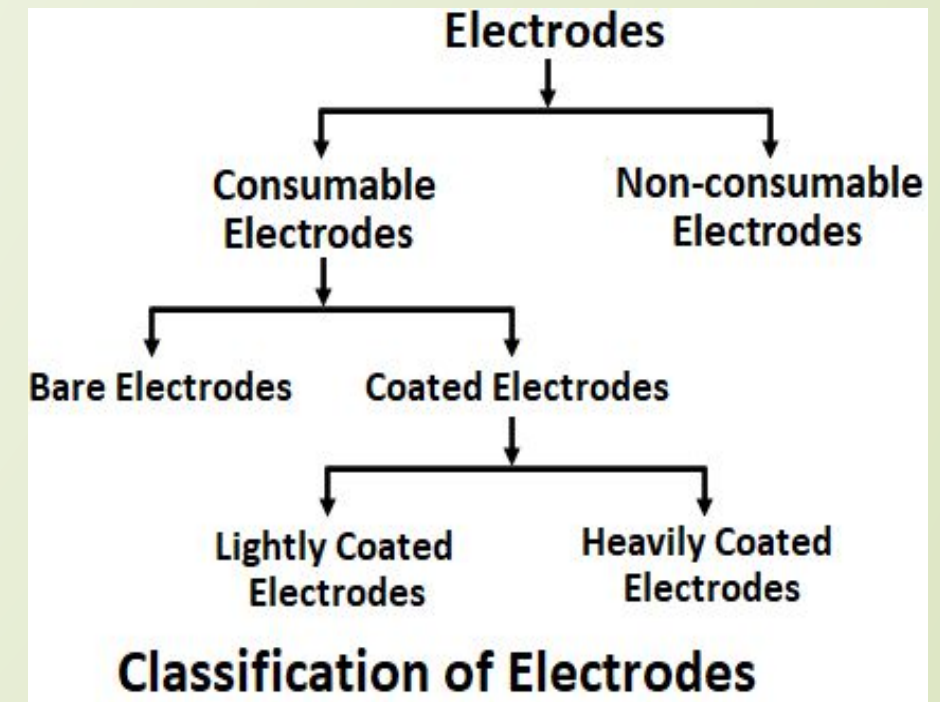


Welding Electrodes

A welding electrode is a piece of rod, which can be of metal or alloy and has a flux or without flux and carries an electric current to obtain sufficient heat for welding.

Classification of Electrodes

1. *Consumable Electrodes*
2. *Non-Consumable Electrodes*



1. Consumable Electrodes

The electrodes which melt due to heat developed by the arc and become part of the weld bond are called consumable electrodes. The main characteristic of consumable electrodes is that they have a low melting point.



2.Non-consumable electrodes

The electrodes which do not consume during the welding process i.e., which do not melt away by arc heat and fuse on the weld bead, are called non-consumable electrodes. The electrodes of this type have high melting points.this type of electrodes can be used for a longer time.



Different Types of Joint

1. Butt Weld Joint
2. Tee Weld Joint
3. Corner Weld Joint
4. Lap Weld Joint
5. Edge Weld Joint

1. Butt Weld Joint

The Butt Weld Joint is that in which the ends of two metals are welded together by placing them side-by-side or end-to-end.



2. Tee Weld Joint

When two surfaces, one horizontal and one vertical are joined at a 90-degree angle, and welded together to make a 'T' shape it is called a T Joint.



3. Corner Weld Joint

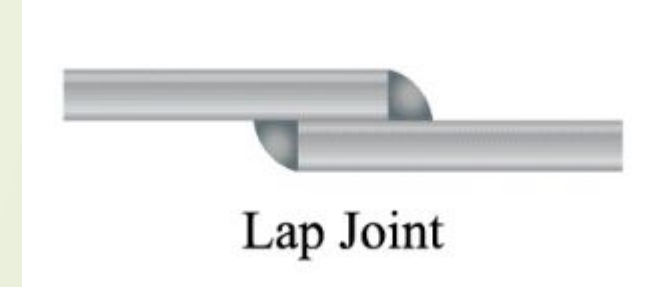
A Corner Joint involves welding two parts of metal by placing the corners of two pieces at a right angle (either open corners or closed corners) to form an L-shaped piece.



4.Lap Weld Joint

31

It is used for welding two metal pieces of varying thickness which involves placing the two pieces one above the other in an overlapping position.



5.Edge Weld Joint

An Edge Joint involves welding the surface edges of two adjacent pieces together that are placed on parallel planes.



Welding Position

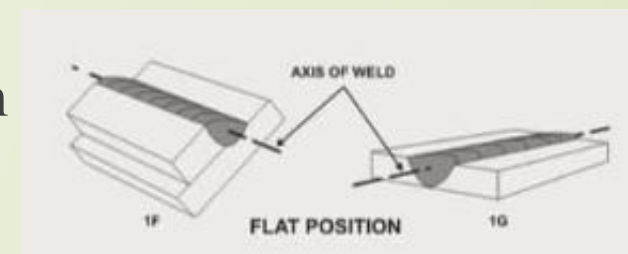
Welding position is a technique of joining metals in the position in which the component will be used.

Types of Welding Positions

- Flat Welding Position
- Horizontal Welding position
- Vertical Welding position
- Overhead Welding position

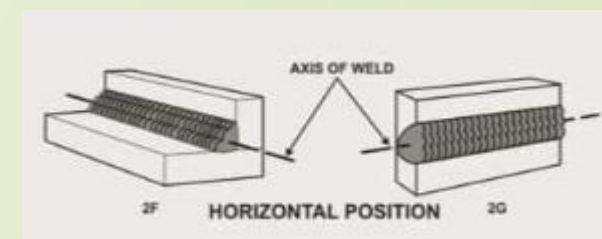
1.Flat Welding Position

A flat position is the common type of weld. It is the first weld that beginners learn. In this position, you are not welding against gravity. The work pieces that are to be welded are placed flat. An electric arc is passed over the workpieces in a horizontal direction. The top surface of the joint is welded allowing the molten metal to flow downward into the joint groove or edges.



2.Horizontal Welding position

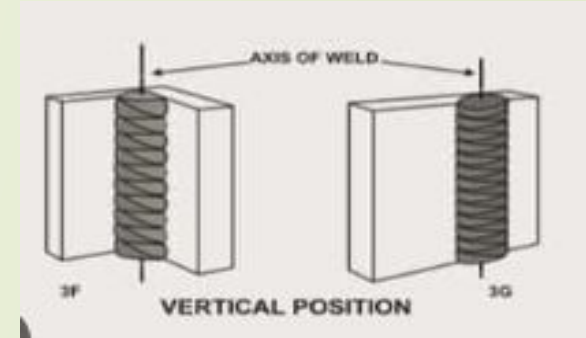
A horizontal weld is considered an out-of-position weld. It is more challenging to perform than vertical and overhead positions and requires higher skill. In the horizontal position, the weld axis is roughly horizontal. The position is executed based on the type of weld. For a groove weld, the weld face is along a vertical line. In fillet weld, the weld bead is done where the horizontal and vertical surfaces of the metals meet at a 90°.



3. Vertical Welding position

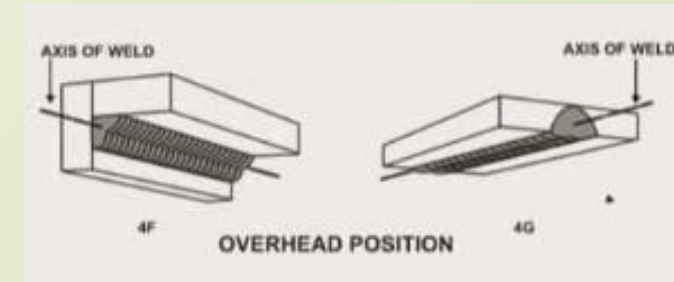
34

Vertical up is mostly used on thicker materials and on large weldments where it is difficult to move to flat or horizontal position. One of the major challenges of vertical welding position is that the force of gravity pulls the molten metal downward and piles up the metal. Welding in a downhill or upward vertical position can help prevent this issue.



4. Overhead Welding Position

The overhead welding position is done from the underside of the joint. It is the most difficult and complicated position requiring a high skill level. In this position, the welding is done with the metal pieces above the welder. Therefore, welders mostly find themselves lying on the floor for overhead welding. Make sure to find the most comfortable position to gain easy access to the joint for welding. Overhead welds are mostly used on metals or fixed equipment that cannot be moved.



Advantages & Disadvantages of Welding

35

Advantages

- ❑ Welding establishes strong, durable, and permanent joint links.
- ❑ It is a simple process that results in a great finish.
- ❑ It is used in various sectors like construction, automobile, and many more industries.
- ❑ Welding can be a fast process, increasing production rates and reducing lead times.

Disadvantages

- ❑ It is hazardous when performed under the safety and security guidelines.
- ❑ It is a difficult task to dismantle the joined material through welding.
- ❑ Requires skilled labor and electric supply.
- ❑ Welding equipment and consumables can be expensive, and the process itself may require significant setup time and labor

Discussion and Conclusion

36

- In conclusion, Arc welding is a versatile and widely used welding process that joins metals using an electric arc. It offers advantages such as high welding speeds, suitability for various metals and thicknesses, and accessibility in various environments. However, it requires skilled operators, adequate safety precautions, and proper equipment maintenance to ensure quality welds. Overall, arc welding remains a fundamental technique in various industries for its efficiency and effectiveness in joining metal components. This process can be conducted using various methods, including shielded metal arc welding (SMAW), gas metal arc welding (GMAW), and gas tungsten arc welding (GTAW), among others. This versatility contributes to its prevalence in industries such as construction, automotive manufacturing, shipbuilding, and aerospace, where different metal compositions are commonplace.

