

## Manual Metal Arc welding

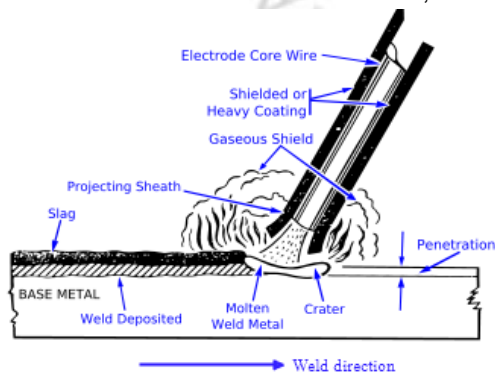
MMAW (Manual Metal Arc welding) or SMAW (Shielded Metal Arc Welding) is:

- An arc welding process in which coalescence of metals is produced by heat;
- The heat comes from an electric arc that is maintained between the tip of a covered electrode and the surface of the base metal in the joint being welded;
- Always done with a consumable electrode with solid metal sheath and coated in flux to lay the weld;
- Striking arc by short cutting;
- Can be done inside or at open air;



The consumable electrode provides:

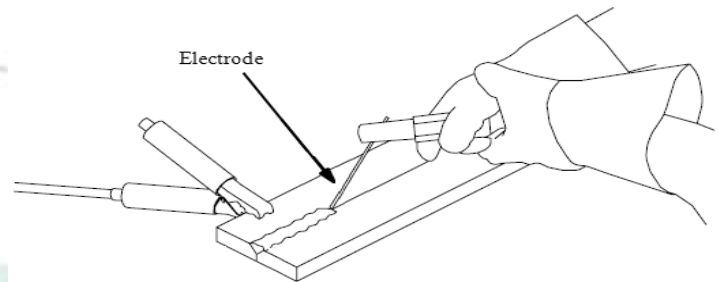
- 1) Gas protection to shield the arc and prevent atmospheric contamination of the molten filler metal;
- 2) Adding elements to change the mechanical properties and prevents excessive grain growth in the welded metal;
- 3) Enhance the mechanical properties and surface cleanliness of the weld metal;



As the weld is laid, the flux coating of the electrode evaporates giving off vapors a layer of slag. The flux provides molten slag which covers the filler metal as it travels from the electrode to the weld pool. Once part of the weld pool is formed, the slag floats to the surface and protects the weld from atmospheric contamination as it solidifies. Once hardened, it should be chipped away to reveal the finished weld.

During welding the current remains constant, even if the arc distance and voltage change. The MMAW machines have static dropping characteristic.

The deposit rate is inferior to 1kg/h and the arc time is about 30%, due to the permanent need to change the consumable electrode.



**DCEN (Direct Current Electrode Negative):**  
Causes heat to build up in the electrode, increasing the electrode melting rate and decreasing the depth of the weld;

○ **DCEP (Direct Current Electrode Positive):**  
Increases the weld penetration;

○ **AC (Alternating Current):**

The resulting heat distribution provides a balance between the melting rate and penetration;

➤ **Applications:**

- Maintenance and repair industries;
- Naval Industry;
- Pipelines;
- Offshore platforms;
- Construction of steel structures;
- Weld carbon steel, low and high alloy steel, stainless steels, cast iron, aluminum, nickel and copper alloys;

➤ **Advantages:**

- Equipment cheap, versatile, simple and portable;
- Welds any position;

➤ **Disadvantages:**

- Smokes prejudicial to health;
- Electrode type choice is crucial;
- Hygroscopic electrodes;
- Need to remove slag immediately due to inclusions problems;
- Quality depends on welder skill.