

## MMA or SMAW

### Definition

Shielded metal arc welding is a process in which the joining of metals is produced by the heat of an arc between a covered electrode and the base metal.

### Process Description

The electrode and work are part of the circuit illustrated in Figure 1.1. Welding commences when the arc is struck between the electrode and workpiece. Tiny globules of molten metal rapidly form on the tip of the electrode and then transfer through the arc stream into the molten weld pool. The electrode is moved at an approximate arc length and travel speed adding filler metal to the fusion pool.

The electrode has a solid metal core encased in a covering. The core conducts the current to the arc and provides the filler metal for the joint. The covering provides arc stability and protection from atmospheric contaminants. Protection is given by a slag covering the transferring filler metal and a shielding gas produced from the flux covering the Process.

During the solidification slag rises to the surface of the weld pool.

The relationship between the volume of shielding gas and slag produced to protect the weld during the process depends on the type of electrode used.

### Process Applications

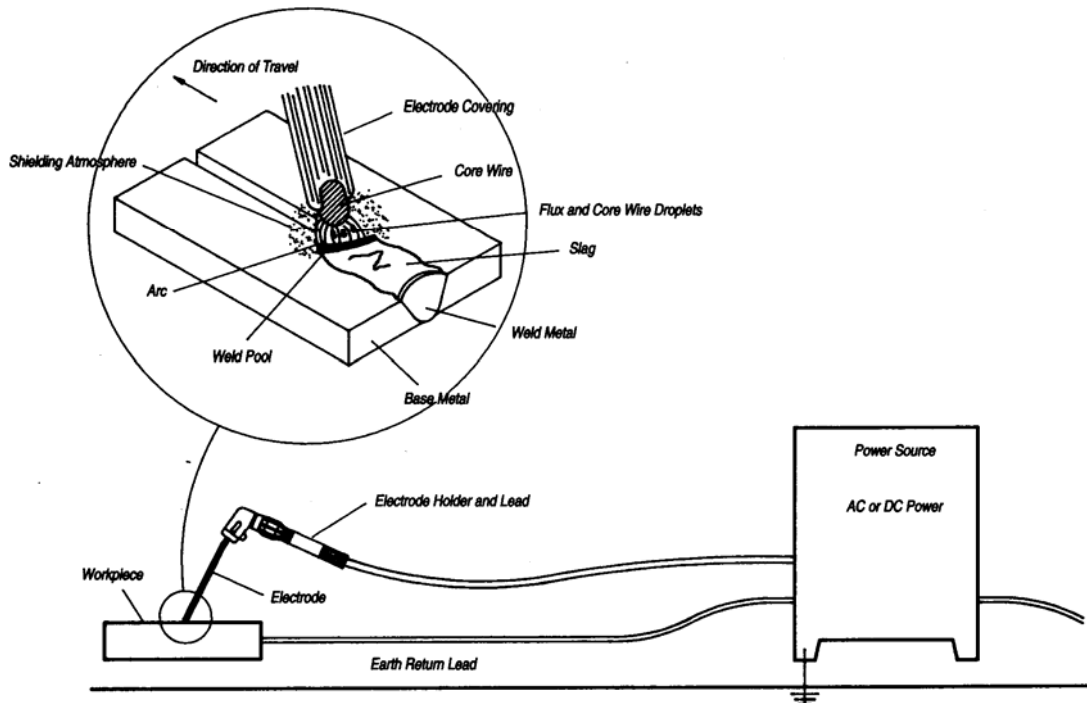
SMAW electrodes are available to weld carbon and low alloy steel, stainless steels, cast irons, copper and nickel alloys and for some aluminium applications.

### SMAW Process Advantages

1. The equipment required is relatively simple, inexpensive and portable.
2. Auxiliary gas shielding is not required.
3. The process is less sensitive to draught than gas shielded processes.
4. It can be used in areas of limited access.
5. It is suitable for most commonly used metals and alloys.

Figure 1.1

A Typical Welding Circuit for Shielded Metal Arc Welding



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### SMAW Process Disadvantages

1. When an Electrode length has been consumed the electrode must be replaced.
2. Generally slag must be removed at starts and stops, before depositing the next weld bead.
3. Deposition rates are lower than continuous electrode processes.

### Accessory Equipment

#### Electrode Holders

An electrode holder is a clamping device used to hold the electrode and conduct the welding current from the welding cable.

Electrode holders are produced in sizes to accommodate various electrode diameters and current carrying requirements.

#### Earth Clamps

An earth clamp is a clamping device to hold the earth return lead to the workpiece. Spring loaded clamps are suitable for light duty applications and heavier screw type clamps for higher current requirements.

#### Welding Cables

Welding cables are used to connect the electrode holder and earth clamp to the power source. The welding cable consists of stranded copper or aluminium wires enclosed in a flexible insulating jacket.

Welding cable is produced in a range of sizes. The size of cable required for an application depends on the amperage to be used and the length of the welding circuit. Cables are increased in size as the length of the welding circuit increases to keep the voltage drop and power loss to acceptable levels. When aluminium cable is used it should be two sizes larger than the recommended copper cable.

If long cables are required, short sections can be joined by cable connectors. Care must be taken to avoid damage to the jacket of a cable, particularly the electrode cable, hot metal or sharp edges may penetrate the jacket and short it to earth.

#### Cable Connectors

Cable connectors are used to attach electrode and earth return leads to the power source and join shorter lengths or welding cable. The connection between cable and connector must be strong with low electrical resistance.

**Table 1.1**  
**Recommended Copper Welding Cable Sizes**

Power Source		Cross Sectional Cable Requirements (mm <sup>2</sup> ) for various cable lengths				
Size in Amperes	Duty Cycle %	0 to 15m	15 to 30m	30m to 45m	45 to 60m	60 to 75m
100	20	19	26	30	35	40
180	30	26	30	35	35	40
200	60	35	35	35	40	48
200	50	30	30	35	40	48
250	30	30	30	35	40	48
300	60	48	48	48	56	67
400	60	56	56	56	67	79
500	60	56	56	67	67	79
600	60	56	56	67	79	Use 2 67mm <sup>2</sup> cables in parallel

**MMA**