

Welding Processes:

KEY POINTS / QUESTIONS:

DETAILS / ANSWERS:

MANUAL METAL ARC WELDING (MMA):

1. **PRINCIPLE:**

Electricity is passed through a consumable electrode which jumps between the electrode and the workpiece. This forms an arc which produces immense heat melting the electrode and the workpiece causing the edges to fuse together.

2. **FUNCTIONS OF ELECTRODE:**

- To protect the weld pool from oxidation via gasses produced by the chemicals in the electrode coating.
- Acts as a filler material filling the gap between the parts being joined.
- Forms a slag which has an annealing effect on the joint.
- Helps maintain the arc.
- May contain alloying materials which mix with the molten metal, giving the weld certain properties.

METAL INERT GAS WELDING (MIG/MAGS):

1. **PRINCIPLE:**

Electricity is passed through the spool fed, consumable wire electrode which jumps between the electrode and the workpiece. This forms an arc which produces immense heat melting the electrode and the workpiece causing the edges to fuse together. The weld pool is shielded by the inert gas Argon, which prevents oxidation.

2. **USES:**

Can be used to join both thin sheet metal and thick metal plates as it's a very versatile welding process.

TUNGSTEN INERT GAS WELDING (TIG/TAGS):

1. **PRINCIPLE:**

A high frequency DC current is used to start the arc. Electricity is then passed through the non-consumable tungsten electrode which produces immense heat melting the workpiece causing the edges to fuse together. Filler material in rod form is added manually if required. The weld pool is shielded by the inert gas Argon, which prevents oxidation.

2. **USES:**

A specialised welding process which is suitable for welding aluminium and stainless steel

RESISTANCE SPOT WELDING:

1. **PRINCIPLE:**

Components to be joined are placed between the two electrodes. The electrodes are presses together and current is passed through. The resistance from the pieces generates heat forming a nugget weld and fusing the pieces together.

2. **ELECTORDE SHAPE:**

Cylindrical bar with tapered ends.

3. **WELD JOINT:**

A single nugget weld.

4. **USES:**

Used in the automotive industry e.g. body panel assembly.

RESISTANCE SEAM WELDING:

1. **PRINCIPLE:**

The pieces to be joined are placed between the two roller electrodes. The rollers pull the pieces along and pulses of current are passed through at set intervals to produce a continuous seam of overlapping nugget welds.

2. **ELECTORDE SHAPE:**

Disk shape electrodes that rotate.

- 3. **WELD JOINT:** A continuous seam of overlapping nugget welds, that overlap by a third.
- 4. **USES:** In applications where a continuous tight weld is required e.g. fuel tanks or radiators.

SUBMERGED ARC WELDING (SAW):

- 1. **PRINCIPLE:** Electricity is passed through the spool fed bare wire electrode. This generates an arc between the electrode and the workpiece producing immense heat. Flux in powder form is fed from a hopper to completely cover the joint and the tip of the electrode. The heat generated melts the edges of the piece, flux and electrode fusing the pieces together and forming a protective slag atop the weld pool. Excess flux is then vacuumed up and reused. SAW is a fully automated welding process.
- 2. **USES:** Used for large scale, straight line, continuous welds e.g. in bridge and shipbuilding and in the production of steel girders.

ELECTROSLAG WELDING:

- 1. **PRINCIPLE:** This is an automatic welding process used to join thicker plates. The large gap between the plates is filled with molten metal. Water cooled copper shoes cool the molten metal preventing it from escaping. The carriage, shoes and electrode all move together, leaving behind a solidified weld.
- 2. **USES:** Used to join thick plates when there is a large gap between them.

Summary: