



# WELDING

## MEDDING

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**W**elding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both, forming a join as the parts cool. Welding is usually used on metals and thermoplastics but can also be used on wood. The completed welded joint may be referred to as a weldment.

The parts that are joined are known as a **Parent material**. The material added to help form the join is called **filler** or **consumable**. The form of these materials may be referred to as parent plate or pipe, filler wire, consumable electrode (for arc welding), etc.

## HOW DOES WELDING WORK?

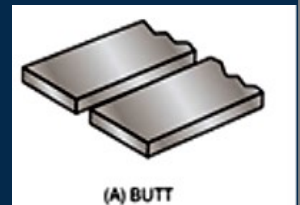
**A) For Metals:** Heat at a high temperature causes a weld pool of molten material which cools to form the join, which can be stronger than the parent metal. Pressure can also be used to produce a weld, either alongside the heat or by itself. It can also use a shielding gas to protect the melted and filler metals from becoming contaminated or oxidized.

**B) For Plastics:** the surfaces are prepared before heat and pressure is applied and, finally, the materials are allowed to cool to create fusion.

## WELD JOINT TYPES

### A. BASED ON CONFIGURATION

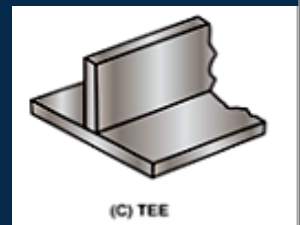
**Butt Joint Welding:** A butt joint is a joint where two pieces of metal are placed together in the same plane, and the side of each metal is joined by welding.



**Lap Joint Welding:** Lap welding joints are essentially a modified version of the butt joint. They are formed when two pieces of metal are placed in an overlapping pattern on top of each other. Welds can be made on one or both sides.



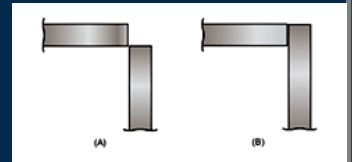
**Tee Joint Welding:** Tee welding joints are formed when two pieces intersect at a 90° angle. This results in the edges coming together in the center of a plate or component in a 'T' shape.



**Edge Joint Welding:** In an edge joint, the metal surfaces are placed together so that the edges are even. One or both plates may be formed by bending them at an angle. The purpose of a weld joint is to join parts together so that the stresses are distributed.



**Corner Joint Welding:** Corner joints have similarities to tee welding joints. However, the difference is the location of where the metal is positioned. Corner joints meet in the 'corner' in either an open or closed manner—forming an 'L' shape. There are two ways of fitting up an outside corner joint—either it forms a V-groove or forms a square butt joint.



## B. BASED ON PENETRATION

**Full Penetration Weld:** Welded joint where the weld metal fully penetrates the joint with complete root fusion. In US, the preferred term is **Complete joint penetration weld**.



**Partial Penetration Weld:** Weld in which the fusion penetration is intentionally less than full penetration. In the US the preferred term is **Partial joint penetration weld (PJP)**.



## TYPES OF WELDING PROCESSES

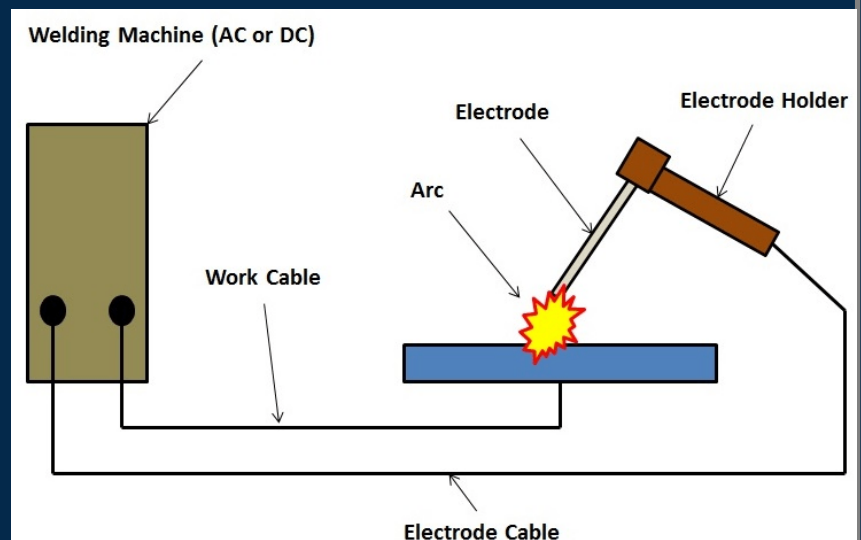
### Gas Welding

The most common gas welding process is oxyfuel welding, also known as oxyacetylene welding. It is one of the oldest and most versatile welding processes. It is still widely used for welding pipes and tubes, as well as repair work. The equipment is relatively inexpensive and simple, generally employing the combustion of acetylene in oxygen to produce a welding flame temperature of about 3100 °C (5600 °F).

### Arc Welding

These processes use a welding power supply (either direct current (DC) or alternating current (AC),) to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point.

Various arc welding types include GTAW, FCAW, GMAW, SAW, SMAW and Plasma arc welding.

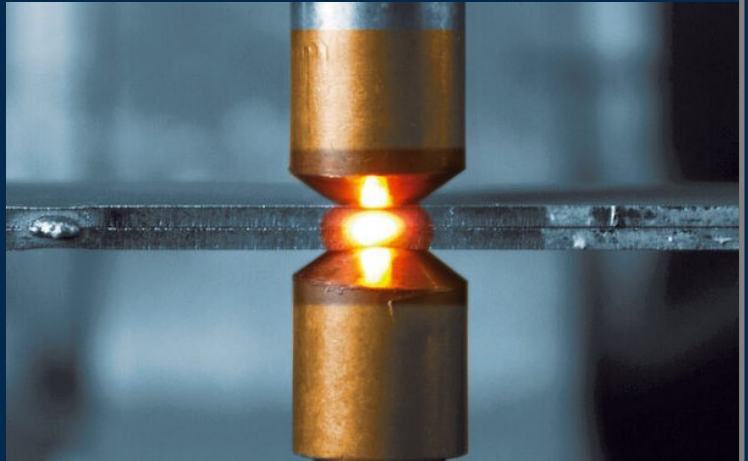




## Resistance Welding

Resistance welding involves the generation of heat by passing current through the resistance caused by the contact between two or more metal surfaces. This method is efficient and causes little pollution, but their applications are somewhat limited and the equipment cost can be high.

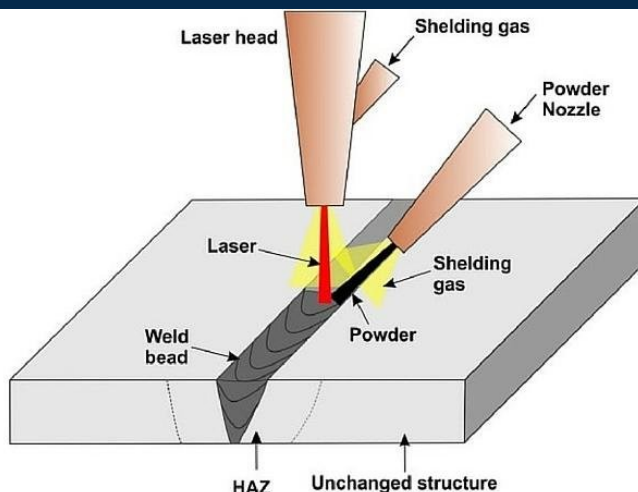
Spot welding is a popular resistance welding method used to join overlapping metal sheets of up to 3 mm thick. Other resistance welding methods include butt welding, flash welding, projection welding, and upset welding



## Electron Beam Welding

Electron beam welding (EBW) is performed in a vacuum (with the use of a vacuum chamber) to prevent the beam from dissipating. This fusion joining process uses a beam of high velocity electrons to join materials. The kinetic energy of the electrons transforms into heat upon impact with the workpieces causing the materials to melt together.

## Laser Welding



Used to join thermoplastics or pieces of metal, this process uses a laser to provide a concentrated heat ideal for barrow, deep welds and high joining rates. Being easily automated, the high welding speed at which this process can be performed makes it perfect for high volume applications, such as within the automotive industry.

