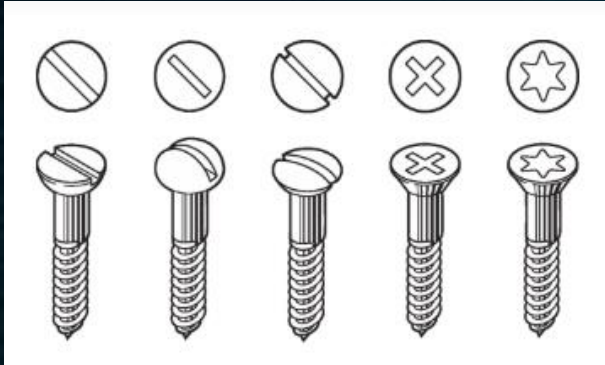


Joining & Assembly

What is Joining and Assembly?

This process involves attaching or putting together parts. The method of joining or assembly is determined by the design because depending on the strength needed (welding) or if something needs to be taken apart (nuts and bolts) this will effect the method chosen. However, when joining pieces together permanently this will often damage one of the parts which can effect the visual appearance of the product.



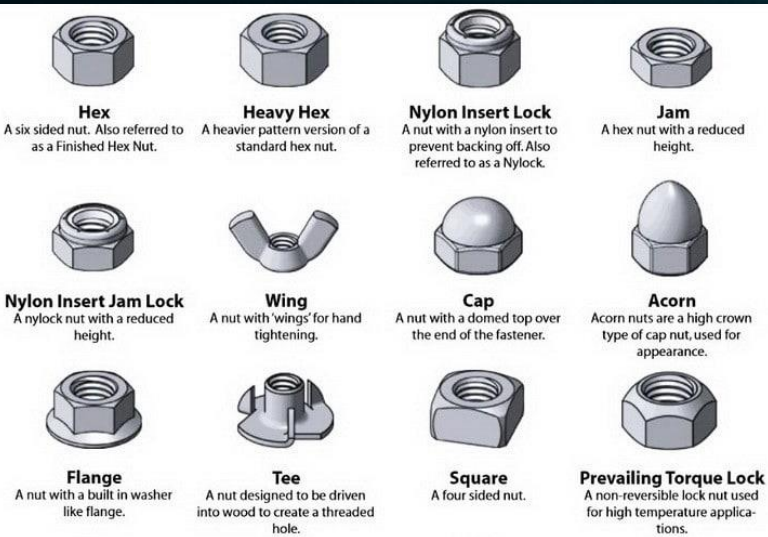
Threaded fastening

This method of joining or assembly involves the use of Nuts and Bolts and Screws. These components can be made out of a variety of materials from metals –steel, brass or plastics such as nylon.

In small quantities attaching materials together using fastenings is completed by hand by using screw drivers or spanners. When larger quantities are needed power tools are used such as pneumatic screw drivers or electric drill with various attachments which will speed up the construction process.

The advantage of fastening is that they can be removed and the product taken apart for either maintenance, replacing a part or when recycling a damaged product. However, fastenings can loosen over time through vibration.

The types of fastening are wide, from Philips head, flat head, allen key, round head, counter sunk and cheese head. There are also fastenings that lock in place and prevent coming apart.



Rivets

This method involves either hammer or compressing a piece of metal into a shape to attach sheet metals together such as on a ship or plane wing. Rivets are mostly for metals but can be used on plastics or leather.

There are two main types of rivets, a solid or snap rivet where:

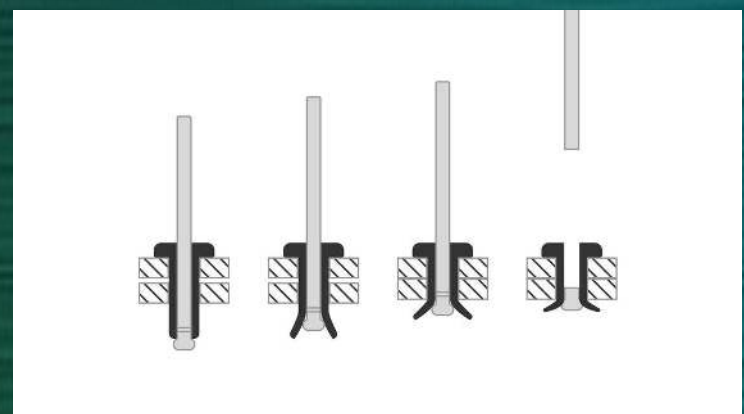
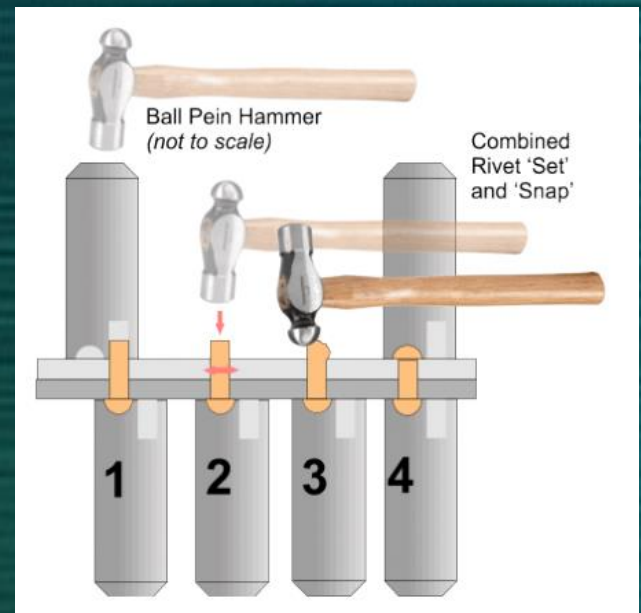
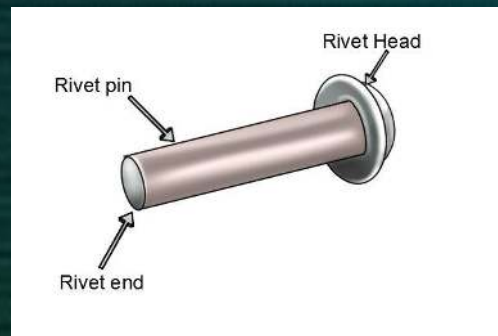
- The sheets metals are over lapped
- A hole drilled through
- The rivet is then placed through
- The end hammered into a rounded off head.

The downside to this rivet is that access is needed on both sides.

Or a Pop rivet where:

- Sheets are placed together
- A hole drilled through
- The Pop rivet placed through
- A rivet gun is used to pull the pin
- This compresses the rivet holds it together

The advantage is that only one side needs accessing.



Joining & Assembly

What two types of joining are there?

.
.

Example:

Example:

Threaded fastenings

What the main advantage of using a Threaded Fastener?

How can Threaded fasteners be put together, what equipment is needed?

What piece of equipment can be used to make the job faster and less tiring?

Sketch down an example of a Threaded fastening

Sketch down the types of heads that Threaded fastening can have

Joining & Assembly

Rivets

What materials can be used when riveting?

- .
- .
- .

Sketch down the process of a simple rivet

Explain how these join two pieces of materials together

Name a disadvantage of using Rivets

Pop Rivets

Sketch down and annotate the process of putting in a Pop Rivet

Soldering

This method of joining is where two metal pieces are permanently joined together. It involves melting solder to join two metals together.

The solder used is an alloy of tin and copper and has a lower melting point than the metals being joined and these don't melt. The solder fills the gap in the joint and holds the two metals together.

If the solder melts below 450 degree Celsius then it is called **soft soldering**, if it melt above 450 then it is called **hard soldering**.

Soft soldering

Soft soldering is used when soldering components to a PCB board. This involves melting the solder to fill the gap between the electronic component leg and the PCB holding the component in place. The solder melts are around 180 – 220 degrees Celsius much lower than the copper on the PCB board.

Wave soldering

Wave soldering is used for large quantities of PCB boards that need to have the electronic components soldered. The PCB is assembled with all components added and is placed just above the bath of molten solder, a ripper across the molten solder allows the solder is flow into the components holes filling them, a film stops the solder from going where is it not needed.

Hard Soldering

This process is sometimes called Silver soldering and is used to join metal parts in jewellery making.

This process differs from Soft soldering by:

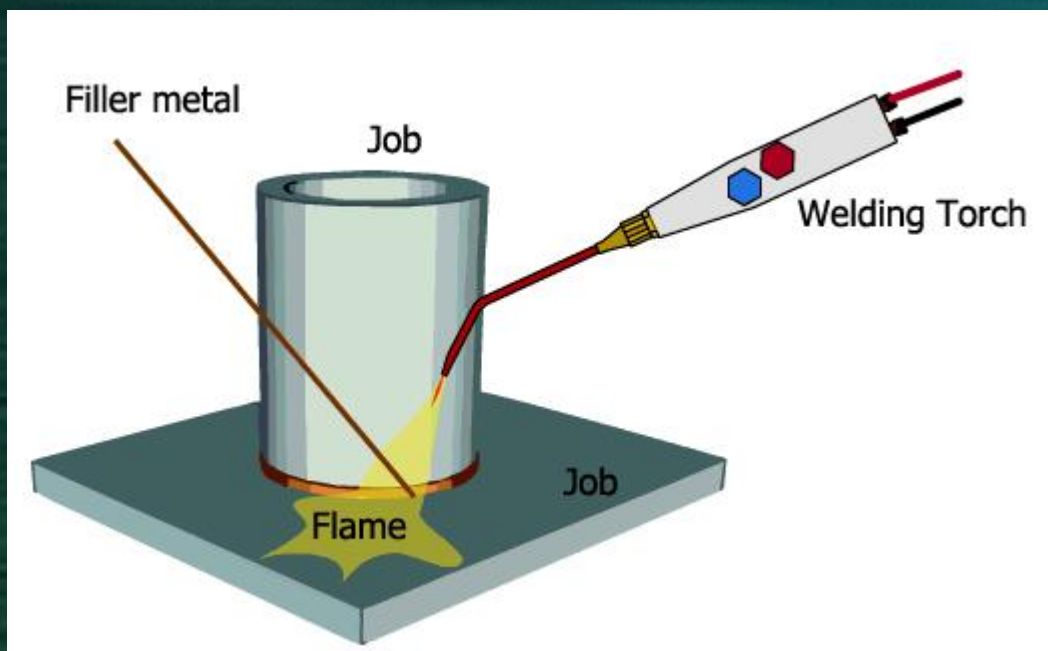
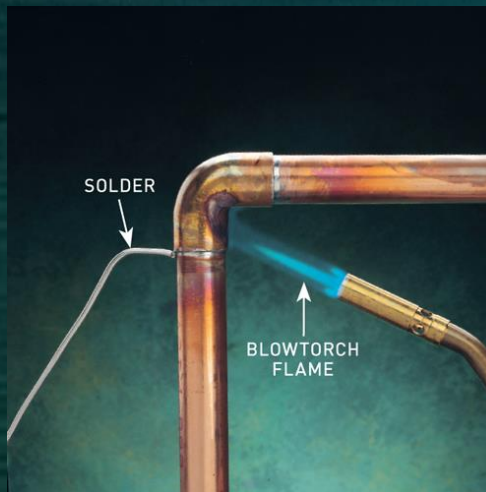
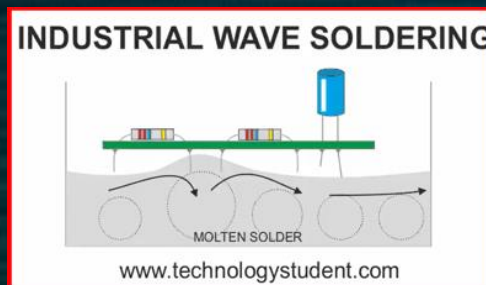
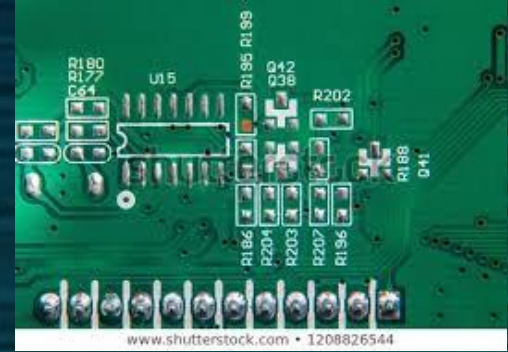
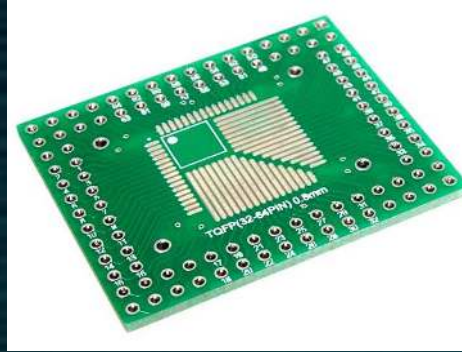
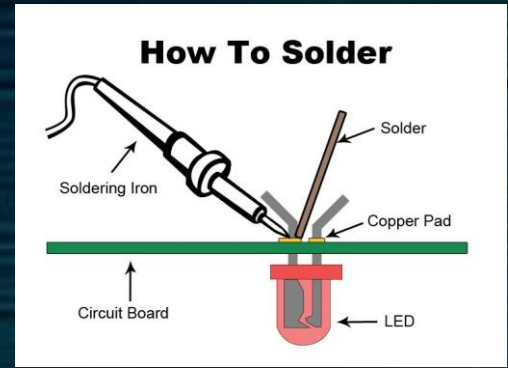
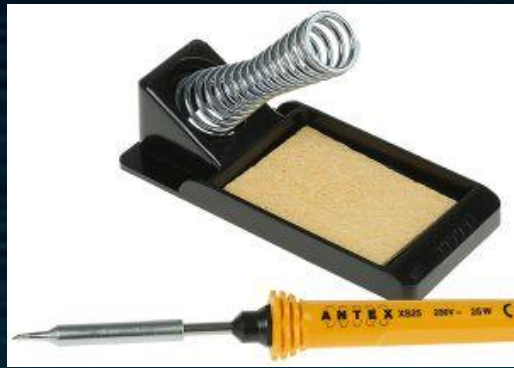
- Melts at a much higher temperature
- Heat is applied using a flame
- Flux is applied directly to the area to be soldered

Brazing

This process is similar to Hard soldering as the material is heated and a filler rod is melted to join the pieces together.

The process of Brazing involves:

- The surfaces to be joined are firstly cleaned to remove oxides, paint or grease.
- A flux is applied to prevent oxidation to the surface of the metal.
- The parts are heated until at the correct temperature
- The filler rod is applied until it melts
- The piece is continued to be heated until the filler rod flows into the joint
- It is then left to cool.



Welding

This method of joining is where two of the same type of metal are joined together permanently.

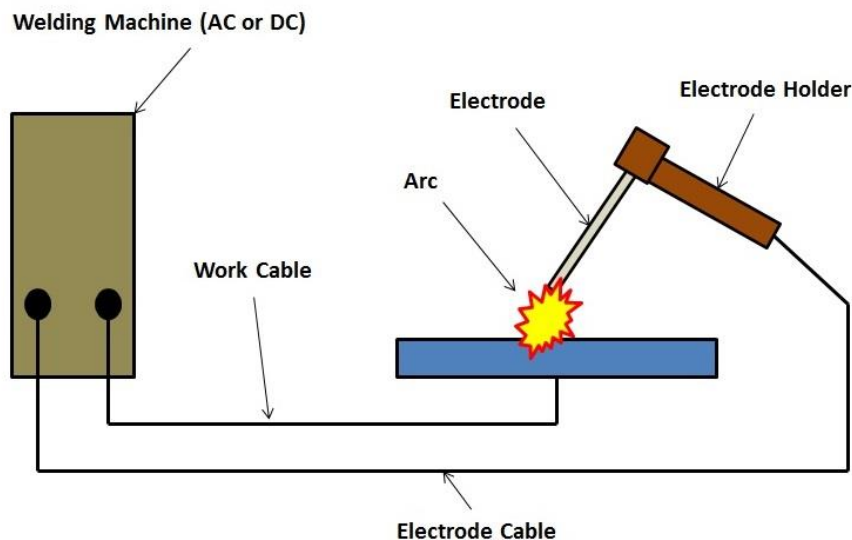
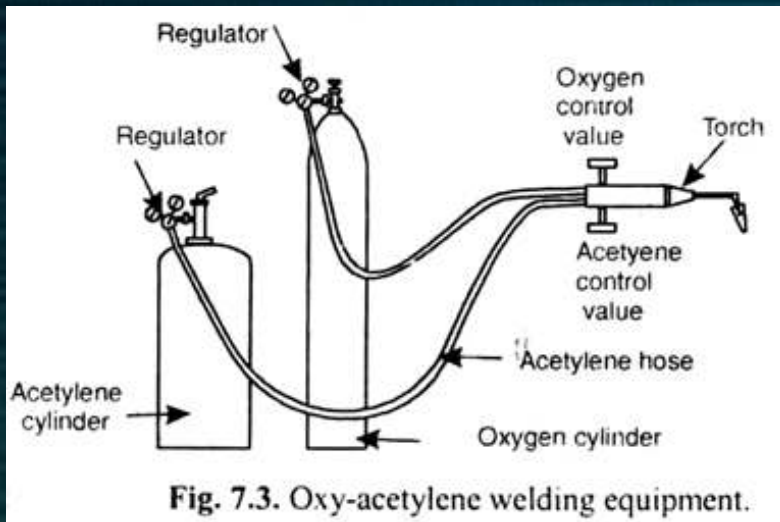
The pieces need to be fully cleaned before welding can begin and a filler rod is used to fill any gap between the pieces to be welded.

In Welding the pieces of metal are physically melted and joined together. This is different from Brazing because the materials in Brazing don't melt just the filler rod melts. Therefore the temperatures are much higher and can be over 3000 degrees Celsius.

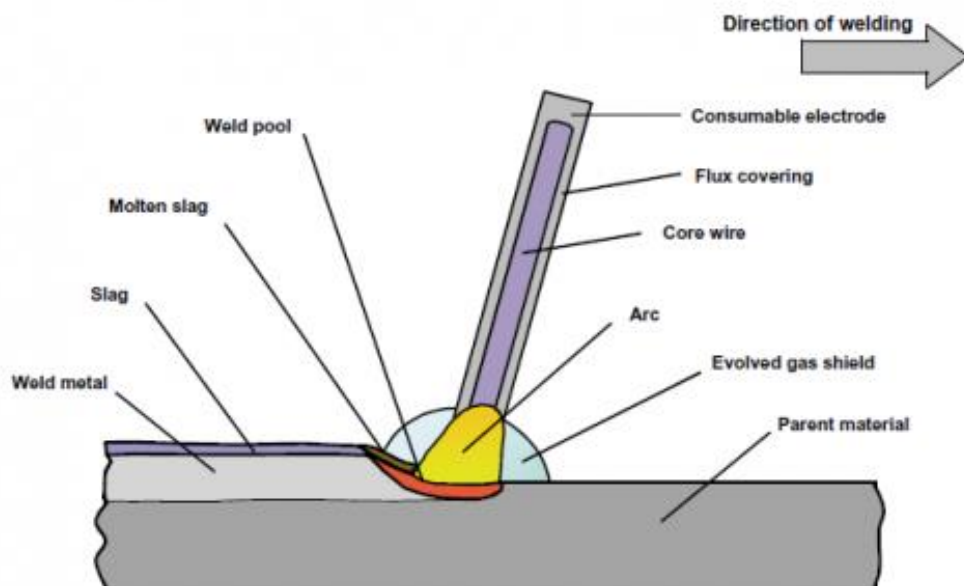
These temperatures can be obtained by burning Acetylene gas and pure oxygen – known as Oxyacetylene welding

Creating a spark between a non-consumable electrode and the work piece with filler rod added separately known as tungsten inert gas (TIG) welding.

Creating a spark between a consumable electrode and the workpiece, where the electrode melts to form the filler wire. This is known as metal inert gas (MIG), metal active gas (MAG) or manual metal arc (MMA) welding.



Basic Arc Welding Circuit Diagram



Arc Welding

This process involves creating an electric spark called an arc, TIG, MIG, MAG and MMA are all forms of arc welding.

The heat source created by the arc continually moves along the joint, melting a small area directly where the heat is applied.

As the heat moves on the area behind it cools and solidifies.

Due to the high temperatures oxidation is a major issue and can create a weak joint, so in TIG, MIG and MAG a shielding gas flows over the arc to spate the joint from the atmosphere. In MMA a flux from the filler rod covers the weld but needs to be chipped off and cleaned away after the joint has cooled.

Joining & Assembly

Soldering

Describe the process of soldering

What is the difference between Hard and Soft soldering

Soft soldering

Where in school is soft soldering used?

What metal make up solder

Wave soldering

Describe the process of wave soldering

Sketch down a diagram to show a good soldered joint

Hard soldering

Describe the process of Hard soldering

Joining & Assembly

How is this process different from Soft soldering?

What metals are used in this type of soldering

Brazing

Describe the process of welding

How is this different from soldering?

Name a metal that is typically used in brazing

When brazing what is an important first step before any brazing takes place?

What purpose does Flux serve when Brazing?

Welding

Describe the process of welding

What is the difference between Welding and Brazing?

Joining & Assembly

Name three things that can achieve this difference

- .
- .
- .

Arc welding

Describe the process of Arc welding

Sketch a diagram to show one of the welding processes

Describe what spot welding is
