

# Soldering Guide

## Safety Precautions

- **Never touch the element or tip of the soldering iron.**  
They are very hot (about 400°C) and will give you a nasty burn.
- **Take great care to avoid touching the mains flex with the tip of the iron.**  
The iron should have a heatproof flex for extra protection. Ordinary plastic flex melts immediately if touched by a hot iron and there is a risk of burns and electric shock.
- **Always return the soldering iron to its stand when not in use.**  
Never put it down on your workbench, even for a moment!
- **Allow joints a minute or so to cool down before you touch them.**
- **Work in a well-ventilated area.**  
The smoke formed as you melt solder is mostly from the flux and quite irritating. Avoid breathing it by keeping your head to the side of, not above, your work.
- **Wash your hands after using solder.**  
Solder contains lead.

### Treatment for minor burns

Most burns from soldering are likely to be minor and treatment is simple:

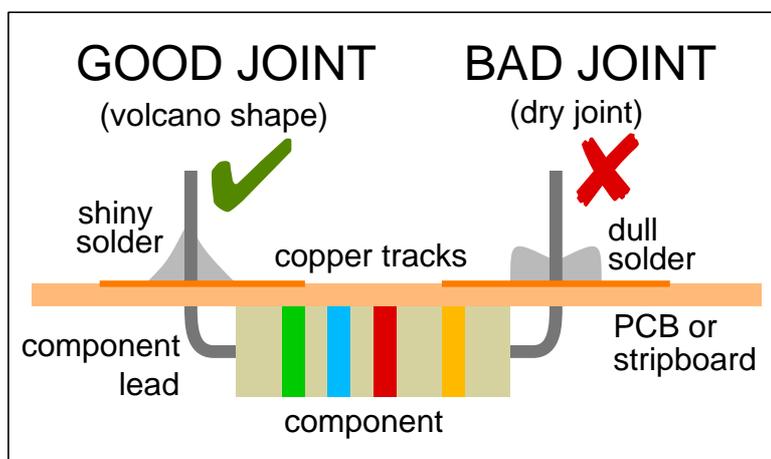
- **Immediately cool the affected area under gently running cold water.**  
Keep the burn in the cold water for at least 5 minutes (15 minutes is recommended). If ice is readily available this can be helpful too, but do not delay the initial cooling with cold water.
- **Do not apply any creams or ointments.**  
The burn will heal better without them. A dry dressing, such as a clean handkerchief, may be applied if you wish to protect the area from dirt.
- **Seek medical attention if the burn covers an area bigger than your hand.**

## Preparing the soldering iron

- **Place the soldering iron in its stand and plug in.**  
The iron will take a few minutes to reach its operating temperature of about 400°C.
- **Dampen the sponge in the stand.**  
The best way to do this is to lift it out the stand and hold it under a cold tap for a moment, then squeeze to remove excess water. It should be damp, not dripping wet.
- **Wait a few minutes for the soldering iron to warm up.**  
You can check if it is ready by trying to melt a little solder on the tip.
- **Wipe the tip of the iron on the damp sponge.**  
This will clean the tip.
- **Melt a little solder on the tip of the iron.**  
This is called 'tinning' and it will help the heat to flow from the iron's tip to the joint. It only needs to be done when you plug in the iron, and occasionally while soldering if you need to wipe the tip clean on the sponge.
- **You are now ready to start soldering!**  
Please turn the page for further instructions...

## Making soldered joints

- **Hold the soldering iron like a pen, near the base of the handle.**  
Imagine you are going to write your name!  
Remember to never touch the hot element or tip.
- **Touch the soldering iron onto the joint to be made.**  
Make sure it touches both the component lead and the track.  
Hold the tip there for a few seconds and...
- **Feed a little solder onto the joint.**  
It should flow smoothly onto the lead and track to form a volcano shape as shown in the diagram below. Make sure you apply the solder to the joint, not the iron.
- **Remove the solder, then the iron, while keeping the joint still.**  
Allow the joint a few seconds to cool before you move the circuit board.
- **Inspect the joint closely.**  
It should look shiny and have a 'volcano' shape. If not, you will need to reheat it and feed in a little more solder. This time ensure that both the lead and track are heated fully before applying solder.



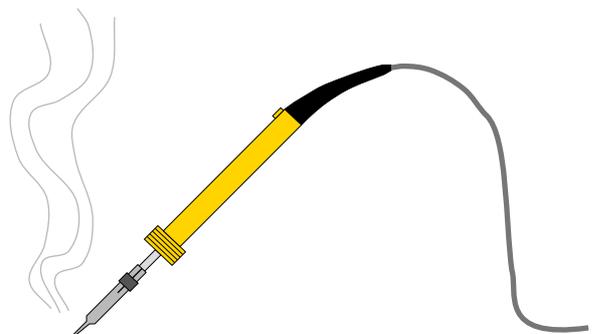
## Using a heat sink

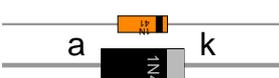
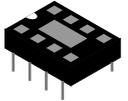
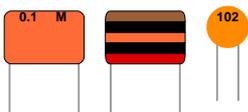
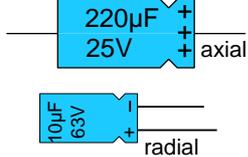
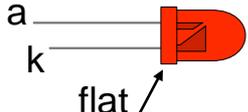
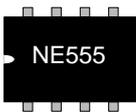
Some components, such as transistors, can be damaged by heat when soldering. It is wise to use a heat sink clipped to the lead between the joint and the component body, as shown in the picture. You can buy a special tool, but a standard crocodile clip works just as well and is cheaper!



## Soldering advice for components

Some components require special care when soldering. Many must be placed the correct way round and a few are easily damaged by the heat from soldering. Appropriate warnings are given in the table on the next page, together with other advice which may be useful when soldering.



Components	Pictures	Soldering advice
<b>Resistors</b>		No special precautions are required. Connect either way round.
<b>Diodes</b>		Diodes must be connected the correct way round: a = anode, k = cathode. Use a heat sink with germanium diodes.
<b>IC holders</b> (DIL sockets)		Ensure the notch is at the correct end. Do <b>not</b> insert the IC at this stage to prevent it being damaged by heat.
<b>Presets</b> (small variable resistors)		No special precautions are required. On stripboard take care to ensure you insert them the correct way round.
<b>Capacitors, non-polarised</b> (less than 1µF)		No special precautions are required. Connect either way round. Take care to identify their value.
<b>Capacitors, electrolytic</b> (1µF and greater)		Electrolytic capacitors must be connected the correct way round, they are marked with + or - near one lead.
<b>LEDs</b> (Light Emitting Diodes)		LEDs must be connected the correct way round: a = anode, k = cathode. Use a heat sink with small (3mm) LEDs.
<b>Transistors</b>		Transistors have three leads and must be connected the correct way round. Use a heat sink clipped to each lead in turn between the joint and the transistor.
<b>Wire links between points on the board</b>		Use tinned copper wire (such as the offcut from a resistor lead) or single-core plastic-coated wire.
<b>Other parts mounted on the board</b>		No special precautions are required for most parts, but make sure they are the correct way round.
<b>Battery clips, buzzers and other parts with wires</b>		Red (+) and black (-) wires must be connected the correct way round.
<b>Wires to parts off the board such as switches</b>		Use plastic-coated stranded wire which is flexible, single-core wire is likely to break at the joint.
<b>Integrated Circuits</b> (ICs or 'chips')		When all soldering is complete, carefully insert ICs the correct way round in their holders. Make sure all the pins are lined up before pushing in firmly.

For further information about electronic components please see: [www.kpsec.freeuk.com](http://www.kpsec.freeuk.com)

## Desoldering

At some stage you will probably need to desolder a joint to remove or re-position a wire or component. There are two ways to remove the solder:

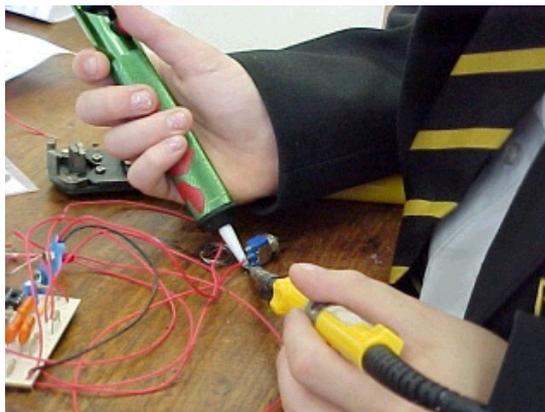
### 1. With a desoldering pump (solder sucker)

- Set the pump by pushing the spring-loaded plunger down until it locks.
- Apply both the pump nozzle and the tip of your soldering iron to the joint.
- Wait a second or two for the solder to melt.
- Then press the button on the pump to release the plunger and suck the molten solder into the tool.
- Repeat if necessary to remove as much solder as possible.
- The pump will need emptying occasionally by unscrewing the nozzle.

### 2. With solder remover wick (copper braid)

- Apply both the end of the wick and the tip of your soldering iron to the joint.
- As the solder melts most of it will flow onto the wick, away from the joint.
- Remove the wick first, then the soldering iron.
- Cut off and discard the end of the wick coated with solder.

After removing most of the solder from the joint(s) you may be able to remove the wire or component lead straight away (allow a few seconds for it to cool). If the joint will not come apart easily apply your soldering iron to melt the remaining traces of solder at the same time as pulling the joint apart, taking care to avoid burning yourself.



Using a desoldering pump (solder sucker)

## What is solder?

Solder is an alloy (mixture) of tin and lead, typically 60% tin and 40% lead. It melts at a temperature of about 200°C. Coating a surface with solder is called 'tinning' because of the tin content of solder. Lead is poisonous and you should always wash your hands after using solder.

Solder for electronics use contains tiny cores of flux, like the wires inside a mains flex. The flux is corrosive, like an acid, and it cleans the metal surfaces as the solder melts. This is why you must melt the solder actually on the joint, not on the iron tip. Without flux most joints would fail because metals quickly oxidise and the solder itself will not flow properly onto a dirty, oxidised, metal surface.

The best size of solder for electronic circuit boards is 22swg (swg = standard wire gauge).

For plugs, component holders and other larger joints you may prefer to use 18swg solder.