Soft Soldering Simplified

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Introduction

Over the years of teaching at the Missenden Abbey Railway Modelling weekends, it has become clear that that one of the biggest problems facing modellers is soldering. Most of the difficulties in kit construction, whether white metal or etched seems to come from not being able to solder. Older modellers may have been taught soldering in metalwork classes at school, or in formal apprenticeships. For various reasons, this does not seem to be the case today. Go to any exhibition where there are demonstrations of modelling techniques and you are bound to find one on soldering.

Why do modellers find this difficult?

There is a tendency to overcomplicate this skill, and some of the newer entrants into the hobby are bewildered by the choice of soldering equipment, and the costs involved. Fortunately, we have a great choice of solders for all the normal modelling tasks, and you do not have to have all the (expensive) equipment now on offer from the trade.

This article is an attempt to demystify and simply the art and skill of soldering, which is an essential skill needed in railway modelling.

What is Soldering?

Soldering is the joining two pieces of metal by melting an alloy (solder) with a soldering iron. The solder melts and flows into the joint. When the heat is removed, the solder solidifies which joins the two pieces of metal. For the solder to flow, it has to be heated to a high enough temperature and the pieces of metal have to be very clean. Flux is used to chemically clean and prevent oxides forming during heating. The joint is a little more complicated than this: The tin in the solder alloys with the copper in the brass and forms a chemical bond.
Different techniques are required for kit construction, wiring and electronics, but they all rely on the same basic process.

Basic Techniques

Choice of Soldering Iron, Solders and Fluxes

This all depends on what you are trying to solder, but most people use an electrical iron. Twenty five watts is a good general compromise for power output, but it is useful for bigger items to have an iron of 50 watts and over. The need for large amounts of heat will be determined by the melting temperature of the solder that is being used: obviously, high temperature solders will need more heat to melt them. I have found that a 50 W iron

with a built-in temperature controller is suitable for nearly all of my soldering requirements (2 mm - 7 mm scale); with occasional use of a small gas torch when even more heat is required.

- When first heating up a new soldering iron make sure that solder is applied to the tip as it warms up. This will coat the iron for easier 'tinning' in the future.

Solder of different melting points is available from the tool stands seen at exhibitions. Carrs market a bewilderingly wide range of solders and fluxes. 144° C 'detailing solder' is a very useful general solder for work on larger pieces of metal. Higher melting point solders are useful for the initial components of a model so that lower- temperature solder can be used for later components. Ordinary multi-core solder will melt at a higher temperature than 144° C detailing solder.

The most critical stage for soldering is to clean up the components to be joined with abrasives such as fibre-glass brushes (work over a margarine tub to catch the fibres) abrasive blocks or wire wool. Any further cleaning will be achieved by the use of a flux. I have always used acidic liquid fluxes – generally phosphoric acid - although there are some concerns regarding their use in an enclosed poorly ventilated environment. Carrs 'Green label' is a very effective commercially available flux for most soldering requirements (not electrical - see below). This is based on phosphoric acid (which is what I actually use). Powerflo paste flux has come to the fore in recent years as an alternative to the paste-based Fluxite (see below) or phosphoric acid. It has been mainly promoted through word of mouth by its devotees, although it contains hydrochloric acid as the active ingredient.

In industry, there is a general prohibition on the use of acid fluxes - especially in a workshop environment, but somehow plumbers can get away with using it! In the home, adequate ventilation should be present. If you are going to be undertaking serious acreages of soldering, perhaps some form of positive extraction of the soldering fumes should be implemented. If you have asthmatic tendencies, then the acidic fluxes would best be avoided.

Paste based fluxes such as Fluxite will also work, but I find that the liquid fluxes help to cool components away from the area of interest, preventing their joints from also melting and are easier to wash off. The most critical aspect for all soldering is to ensure that just as cleaning up beforehand is important, so it is afterwards. Any flux residues must be washed away. Fluxite is zinc chloride in a paraffin wax base. It can be cleaned off with a strong detergent and/or white spirit.

Soldering Etched Brass and Nickel Silver

- As always, the components should be cleaned ready for soldering. They should also fit one another.
- The iron tip is cleaned on a wet sponge before EVERY joint or a suede cleaning brush (only to clean up occasionally) and solder is applied to it.
- The solder should flow over the tip surface and leave a shiny surface: if the solder 'blobs' then the tip is not clean.
- Apply flux to the metal components whilst still separate. Some joints are better fluxed with the components together as capillary action draws the flux into the gap.
- Place the iron with solder on the flux and spread a thin coat of solder over the component: this is 'tinning'.
- Again make sure that the iron is clean: re-tin it with solder.
- Bring the components together with more flux present and then apply the iron near the joint. The iron will need some solder on the tip in order to get efficient heat transference to the components.
- Once the solder on the components has heated up and 'flashed' remove the iron, but keep the pieces completely still as the solder solidifies.
- Check the strength of the joint a 'dry joint' will be brittle and break easily.
- Clean off any excess solder with a sharp scraper and remove any residual flux.

Heavy Stuff like big sheets, large components, tree armatures.

Follow the instructions as above but use extra heat in the form of a gas torch, gas ring electric hot plate etc. If the solder is overheated it will turn crumbly / crystalline and then the component needs cleaning up and you start again. It is a good idea to purchase some refractory bricks or tiles if you are using a flame a lot. Do not use ordinary bricks, they may explode!

Soldering White Metal

Soldering white metal is not really soldering, but welding, as we are using solder that is similar to the alloy to be joined. These solders have a very low melting point, namely 70° C. It is possible to use temperature controllers to reduce the heat output of your soldering iron. An alternative is to simply use a hot iron quickly, with lots of liquid flux. Using an iron that is too cool will lead to a slow increase in temperature of the components with the risk of their slow meltdown… If the components are incorrectly joined then simply put the model in hot water and it will fall apart.

Soldering castings to brass or nickel silver

When soldering white metal castings to brass or nickel silver, tin the surface of the area where the casting is to be fixed, with a slightly wider border,

using ordinary 144°C solder. Clean up the fit surface of the casting and hold it in position with a piece of wood or similar. Apply plenty of flux and then bring the tinned, clean iron to the solder on the brass. You will see the solder next to the component flash under the casting: remove the iron before the casting follows suit!

Layout Wiring

The key requirement is electrical conductivity and the problem of 'dry joints'. These are poor or non-conductors of electricity, and the joint between the electrical feed to the track and the nickel silver rail is a particular problem, especially with plastic based track where it is easy to melt sleepers. When soldering wires to hand made soldered PCB track, always make the joint with the rail not the sleeper, as this may be poorly joined to the rail itself.

With plastic track already laid in situ, acid fluxes must not be used. I always tin the rail first in the vicinity of where the electrical feed is going to be:

- The rail must be clean.
- Multicore solder (this has a resin flux core especially formulated for electrical work) and a clean, tinned, iron are brought into the vicinity of the rail, trapping the solder between the iron and the rail.
- The iron melts the solder and the included flux causes it to flash along the rail web a short distance.
- Remove the iron.

Drill the hole for the wire in the baseboard, feed the wire through the hole and strip a short length of insulation from it.

- The solder and iron are brought together next to the wire, as for the rail.
- The wire is tinned by the flash of solder and a little more of the insulation melts away.
- Bend the end of the wire at a right angle.
- Pull it back through the hole so that the tinned wire sits inside the rail web.
- Hold it in place with a screwdriver and bring the clean, tinned iron against the wire
- The solder will melt in the wire and on the rail.
- Remove the iron.
- Tug the wire from below to check that it is firmly fixed.

Electronics

This is similar to track wiring and if the work is really fine, a smaller tip is a good idea. Pre-tinning components is unnecessary. You must be careful to avoid overheating delicate components when soldering.

Summary

1. Surfaces MUST be clean
2. Correct flux for job
3. Correct Solder for job
4. Enough heat
5. Remove flux and clean up excess solder

What is next?

- Observe the demonstrations and see how it is done. Look at how the solder flows, and what it looks like on a good joint
- Understand the process
- Try it out for yourself on some used frets and scraps of metal
- Then *practice, practice, practice!*

In the words of Lao-Tzu

"I listen, I forget;
I see, I remember;
I do, I understand."