Soldering

by Tom Noser

Soldering is an easy matter once you have some experience at it, but can be very frustrating when you don't know the basics, and don't understand what makes soldering work.

It is very important to make good joints, because the joint is either conducting electricity for you, or supporting an aircraft at the landing gear or even holding your wings up, or down in your flying and landing wires. The various jobs to be done will require solder of "different" tensile strengths and therefore different material composition.

Our soldering experience usually begins with the relatively easy task of joining two wires or joining a wire to a post or clip for electrical work. In this case we are working with low temperature material, melting at 340 degrees, made up of 60/40 tin/lead (60% tin and 40% lead) a very common and readily accessible material called "radio solder" having an internal core of rosin for a flux (the material which cleans the surfaces you intend to join.) This type is meant to serve as an electrical solder only and does not have sufficient strength to use it for structural purposes. It is applied with a soldering iron of any number of types, or a soldering gun of the instant heat type.

Radio work, for me, usually involves putting additional lead between the servo and the plug, or making up "y" harnesses. For this work I use a pencil iron with fifteen and thirty watt temperature settings set to thirty watts. Also I use a small wire stripper, a pair of needle nose pliers, a set of diagonal cutters and some shrink tubing.

The most important point in soldering is to "always" have a mechanical connection before attempting a solder connection. Solder has little strength of its own. Solder does immobilize closely related items giving a mechanical joint between wires the full strength of the smaller wire.

Another important item is the flux. All metals corrode, and this corrosion must be removed before a solder will bond to the surface of the metal. The flux is an acid which does this molecular cleaning, enabling a bond between the molecules of tin, lead and copper, or whatever material you are joining.

There are different chemicals used for different temperature solders and different metals. Radio solder uses pine rosin to do clean your wires, usually copper. If the solder is "beading" up on your base material, it is because the flux you are using isn't cleaning that material. Passing a file, steel wool or sand paper (wet - or - dry) over the surface will sometimes solve the problem, enabling a flux to get to the base material and clean it. Other times you need to try a different flux.

In high temperature work, such as silver soldering, borax is used for the flux.

To make a soldered joint between two wires, strip some of the insulation from the ends of the two wires, twist the wires together, apply a small amount of rosin core solder to the tip of your iron, heat the joint with the liquefied solder at the same time you apply solder to the wire joint on the side opposite your iron to be sure the wire is hot enough to melt the solder. If you find the solder won't flow into the joint, remove the heat, apply a little flux to the joint, and then re-heat and re-apply your rosin core solder.

A cold joint can result from heating your wire solder with the iron instead of the wire which you are soldering. When the wire is hot enough to melt the solder, the solder will wick along the joint in a very fine coat and color the wire silver wherever it bonds to the wire. A good joint needs very little solder and need have no lumps of solder on it. This is especially true when you use tinning . Tinning is preparing one or both of the items to be joined by pre coating with solder. Use this method when working with small, delicate parts which may be mounted in plastic or may be subject to damage by the application of excess heat such as a battery tab.

To tin a tab, coat the area to be soldered with flux, apply a small amount of solder to the point of the iron and touch it to the item. The solder will quickly coat the fluxed area and the heat can be removed. To fix a wire to the tab, flux the wire, place the wire against the tab, touch the wire with the iron until the solder on the tab and the iron tip flow onto the wire, and remove the iron.

In the interest of neatness and preventing corrosion, you should always keep a damp sponge at hand to wipe newly soldered connections free of flux, and on which you should often wipe your iron to keep the tip from deteriorating due to the action of the flux.

The soldering gun is useful for working with wire of No. 16 Ga. and larger for household and audio speaker work, but is too large and too hot to be used for radio and servo work.

For high strength work you will need silver solder. You can buy a silver solder at the hobby shop, but you will find that it has a relatively low silver content and therefore a low melting temperature and questionable structural strength. The flux that comes with it is extremely useful as a flux for radio soldering. I apply a drop of this flux to wire joints to make the solder take to the joint easier and thereby reducing the heat I have to use to finish the joint. I used this sliver solder to make landing gear when I first started scratch building. The joints held up well except in high stress situations, but I never lost a plane because of solder joint failure.

Silver solder referred to on "plans" is not a low temperature material. The good stuff is available from Lathrop’s Jeweler’s Supply, 6702 Ferris, off Bellaire Blvd. In Houston, TX.

Lathrop’s has the solder in three different temperature grades so that you can make joint assemblies which can be soldered at high temp and then assembled to each other at lower temp.

Lathrop's have solder in small and large quantities, and I use small quantities of the high temp, and larger quantities of the low temp material. They tell me that "Easy" melts at 1240° F and flows at 1325° F. "Medium" melts at 1275° F and flows at 1360°F. "Hard" melts at 1365° F and flows at 1450° F. All of these temperatures are attainable with a Propane torch, but not on large items.Also at Lathrop’s you will find jeweler’s saw blades in all sizes. I buy a dozen each of their three smallest sizes, I think they are 4-0, 5-0 and 6-0. The 6-0 does a job on brass tubing with a 1/64 wall thickness. If you don’t have a jewelers saw frame, get one. It is what you cut metal with. Always set up the blade to cut on the pulling stroke. Lathrop’s sells tools.

Back to my landing gear. The plans always tell you to "bind and solder." I think a better way is to use a brass tube to hold the parts together. Just find a size that will fit snugly around the group of wires you are working with. A ½" length should be sufficient. Put a liberal amount of flux on each piece of the wire set and re-assemble with the brass tube. Heat the set with a pencil point flame on the largest piece of wire and move the flame to heat

everything evenly. When the flux turns to clear liquid on the metal, the temperature is approaching a melting temp of the "easy" solder, about 1240°F.

Touch the solder to the work without exposing the solder to direct flame and let the heat of the metal melt the solder. As the solder begins to melt, move the flame away from the work slightly to reduce the temperature rise in the work, and move the flame about to distribute the solder evenly. Be sure to put plenty of solder on the work, being careful not to over heat it. When finished, quench the work in cold water.Wash the joint well in cold water to remove as much flux as possible and steel brush the joint clean. Use a piece of wet - or - dry sandpaper to clean the wires to a bright finish, and then heat the joint until the wires go through the surface colors of light straw, dark straw then dark brown with purple spots. Do this slowly and carefully or the work will turn light blue and you will have gone too far. When a dark blue stage is reached, quench the work in cold water and you have spring tempered gear. Again clean the work with a steel brush and spray with a military flat of any color, all of which are primers and hot fuel proof.

The main difference between radio and silver soldering, other than temperature is silver solder adds strength to the joint by filling in between the various wire parts. Whatever you use to bind the joint, put plenty of solder into the joint. And keep in mind that if you are working with large diameter axle wire, you will need a larger size brass binder wire to hold up to the high temperature you will be using and the long period of time it will be applied to the work.

Those are the main advantages of using tubing as a binder for axle joints. It is less liable to melt away since the heat will be conducted through the tubing to other parts of the joint. You

should concentrate the heat of the flame on the largest wire until all the joint is at a temperature that will melt the solder. Keep in mind that it helps to use plenty of flux in high temp soldering. The work is easier to clean and will stay cleaner through the heating process.

I hope this information will get you started on a project you have been avoiding for lack of confidence in your soldering ability. Just remember, the more you practice, the luckier you get.

Until Next Time!

Tom Noser.