RESISTANCE SOLDERING.

Some observations from experience. by Bob Alderman. © 1997

Introduction

The resistance soldering unit is a tool that supplements the usual soldering iron. Its advantage is that it supplies instantaneous localised heat to the work. This is accomplished by passing a high current at low voltage through a resistance contact at the point of application. The current is in the range 30 - 40 Amps and between 1 to 4.5 volts. Most units have some form of switching to select different voltages and associated currents. The resistance point is usually created by a carbon electrode applied to the workpiece. The switching of the unit is usually achieved by a footswitch.

Choice of unit.

There are a number of different RSU’s on sale. Examine them and make up your own mind, but consider what use you will put it to, long hours continuously, then one which sits there normally ”off” or which probe holder suits you best, and so on. I did my own survey and chose the one that now seems to have been the most popular. Still one man’s meat...

Contact plates.

The usual set up is to have a work board with some form of contact plate connected to the return side of the unit. The RSU is placed wherever convenient, mine sits happily beside the bench, but within reach to change the voltages.

There seems to be much variety of contact plates in their sizes. Some use a steel block with an aluminium foil cover. This has the advantage of being able to use magnets to hold down components, and the disadvantage of giving a large heat sink. Others prefer thin aluminium or brass sheet bonded to a piece of board. I prefer aluminium about 0.015” thick simply stuck to mdf with double-sided tape. As for the size, it is your choice. I have found that all you really need is sufficient area to get one end of a locomotive on, plus a bit. Say about 6 x 4 inches. The sheet needs to be connected to the RSU return lead with a generously sized contact to ensure a low resistance joint. I would suggest a terminal tag that will accept a 4 BA bolt. This should be well tightened using a thick washer to spread the load. I have found it expedient to fit a plug and socket into the return line, the socket should be on the RSU side. It must be at least the same size as those used elsewhere for connection on the RSU (a 3 millimetre dia. pin minimum). See Figure 1.

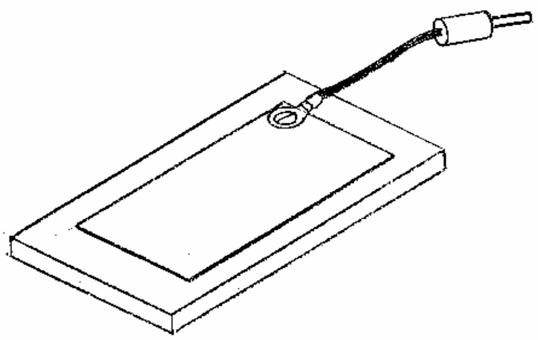


FIGURE 1

Whatever type of contact plate you use it will require periodic maintenance. Inevitably there will be solder and flux residues on it that lead to corrosion and poor contact. This can be easily remedied by rubbing down with a coarse (100/180 grit) wet and dry paper. Of course if you have used it, replace the foil!

As mentioned earlier the steel plate is useful with magnets. This is not impossible with a non- ferrous plate. I have simply placed a small piece of thin steel plate over the plate and used the magnets on this. It helps if one corner is sharpened and bent down slightly to make a good contact with the plate beneath. Any rust on the plate dramatically increases the resistance! So keep it bright. A poor contact shows up with a crackling arc!

Very occasionally access, geometry, or just not enough hands precludes holding the parts or model onto the plate and using the carbon probe. Under these circumstances a short lead soldered to the parts or model in a discreet place can be used instead of the plate. Here is the virtue of having a plug connection to the plate; if the lead has a mating plug then a quick connection can be made. See Figure 2.

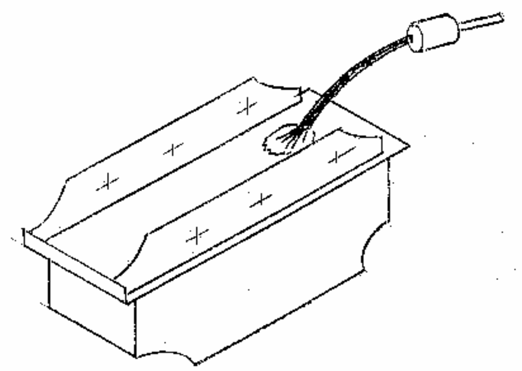


FIGURE 2

I am not a great believer in using a crocodile clip. They can slip and cause arcing which burns the surface and are of themselves a relatively high resistance joint that heats up under the current; power going other than where it is useful. This can be overcome with a large clip but the spring pressures can be great enough to cause mechanical damage!

<u>The Carbon Probe</u>

The carbon rod supplied is copper-coated arc welding rod. All that we need to do is cut to a usable length and create a working tip.

Usually a simple conical point will do for most jobs (See Figure 3). This can be created with a pencil sharpener (others seem to have more success then me with this tool than me!) or a coarse file can be used to shape the end.

Do not feel constrained to using a point all the time, a chisel end (See Figure 4) is useful especially for holding down small components. Sometimes a point, even at the lower voltage settings can be too hot and burn the surface.

A degree of asymmetry in both of the above forms can assist in access to components. It is even possible to file the tip to a crook or other shape to reach into or around really awkward places (See Figure 5). Other shapes can doubtless be devised for particular applications.

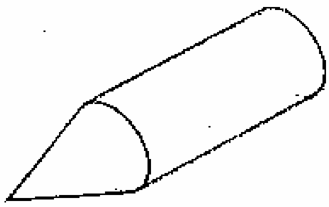


FIGURE 3

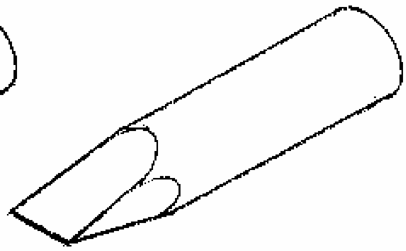


FIGURE 4

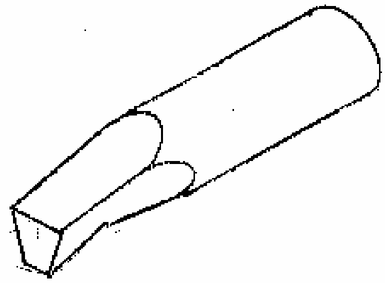


FIGURE 5

No matter what, the tip of the rod will degrade. It absorbs flux residues and also oxidises from the heating. The tip goes grey and rounds-off and will require reshaping. I find that if you do not keep up with this results in failing joints, just not enough heat being generated. Remember that there are also mechanical loads imposed on the carbon. You are using it to hold a component in place as well as heating it. This too, has a detrimental effect on the tip.

Selecting the current and voltage

Selecting the appropriate current or voltage usually comes down to a matter of experience. In general low voltage means lower current and high voltage, high current. It may be better to think of this in terms of either high or low *energy*.

The low energy end of the scale is suitable for very small thin or half etch components, possibly in the metal thicknesses used in 2 or 4mm. scale kits, but not necessarily so, and at the high-energy end, full thickness material or the larger lost wax castings in 7mm. The settings between used to suit. Remember the state of the carbon can have a direct effect on the effectiveness of the energy value!

It is better, initially, to err on the low side, as this will have minimal effect, e.g. the solder will not melt. If, on the other hand, you go too high the probable result is burning a hole in the material at the point of contact, especially with thin material. It is possible to locally melt lost wax brass castings too. With a good point to the carbon, the tip should just glow approaching bright red, not incandescent white. This seems to indicate that “heat supply” versus “heat lost” are in balance. The time of application should be short. If it takes longer than ten seconds then boost the energy

Solders and fluxes.

Overall I use the Carr’s 188 Solder Paint that carries its own flux. The flux residues clean off with water subsequently. I also use various other solders when they have been applied as a tinning coat to surfaces and components. The RSU is then used as to remelt them to complete the joint. I usually use a simple flux like Fluxite or Powwrflow for this. ***I would not recommend a liquid acid flux.*** The intense heating causes it to flash to vapour and to spit. Not the best product to get in an eye!

A similar effect can occur with the solder paint too. The intense heating causes the flux to boil and if the component is not securely located it can be blown off the job! For very small parts I tend to hold the component down with a dental pick and apply the carbon alongside to give indirect heating.

Applying the solder paint can be wasteful. It is easy to apply too much. Often only a pin head amount is required. I have taken to decanting it into a hypodermic syringe and applying it through the needle. The point has been ground square on two counts. One, I do not want an inadvertent “fix” of solder and two, a more precise application can be made without the solder forming a coiled worm. The needle I have has a bore that will pass a 0.3 millimetre diameter wire to clear the occasional blockage. Having squeezed out the solder, back off the plunger otherwise the solder can keep coming due to compressed air above it!

Using the tool.

Perhaps the art of using the tool is in learning the co-ordination of "carbon on - power on - power off - carbon off". Switching the power on before completing the circuit or leaving it on whilst taking the carbon off results in arcing. This is usually dramatic and destructive.

Generally its use is very simple. Apply solder to the component, locate it, apply the carbon and on - off with the current. You can usually see the solder melt and appear around the part after a second or so. I often follow up with a vigorous wire brushing. This is a sure way to detect defective solder joints.

Sometimes it is not always practical to apply the carbon directly. Therefore apply the carbon on the surface behind the component to be located. e.g. to a brass cast axlebox onto tender frames; apply the carbon to the frame on the wheel side. If there is any danger of marking the surface then it will be out of sight. If a high energy burst is needed it may be better to apply it in the same manner. See Figure 6

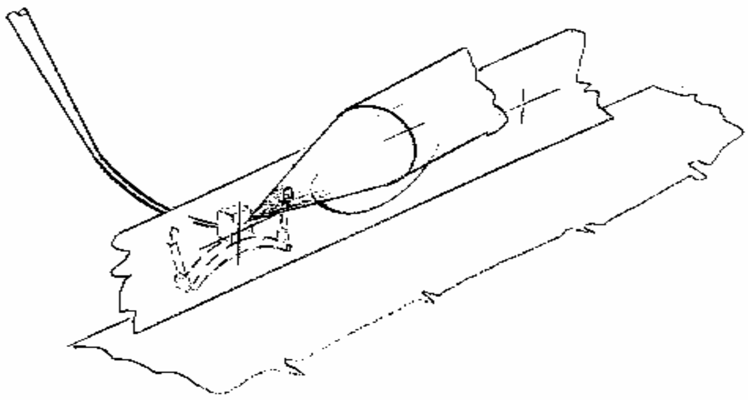


FIGURE 6

With small components it is easy to lose sight of them under the carbon. I hold them down with a dental pick or a scriber and apply the carbon alongside and let the heat flow by conduction. This is particularly true with items like handrail knobs. The heat mass of the knob is so low that even on reduced energy settings it is possible to melt them. This applies to small brass castings too.

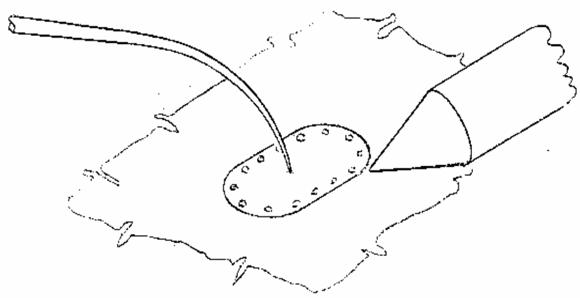


FIGURE 7

Most of the use on sheet work is for the application of overlays. When putting down overlays I usually tin them whilst still in the fret, this gives a good handle to the item and any excess solder can be run off into the surrounding fret. This is done with a normal iron. The item is then removed, cleaned up and, sometimes, if I feel the tinning is too generous, I carefully rub it down on some 180 grit wet and dry. It will need wiping clean after this. Apply solder paint and locate. If, for instance, it is a rectangle of rivet detail on a cabside, tack it at one corner and check its location. If the location is satisfactory move to next corner, then to the one *diagonally* opposite, and then the final corner. Go around filling in the gaps, centre top to centre bottom, similarly left and right, then the half gaps and so on until complete the aim being to maintain an even heat distribution.

Try this on a scrap length of half etch strip. Solder one end down, then the other. Progressively solder from one end to the other. A large ruck will form as the metal expands and has nowhere to go. This is what to avoid. See Figure 8

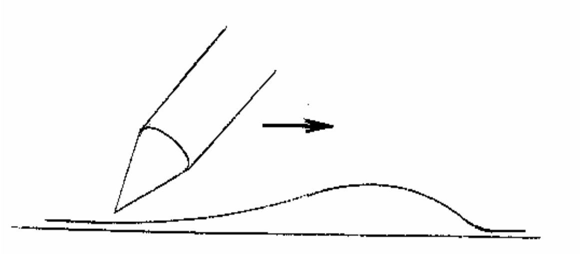


FIGURE 8

Although I have not had any success myself with butt joints, I have seen a valance being soldered to a footplate. Here the valance was tacked at the ends and middle. Short lengths of thin solder wire (not cored) were located in the corner between the valance and footplate. The carbon was applied and as the solder melted the carbon was drawn along the surface in *sustained contact*. The solder melted into the joint. Again this was done to minimise expansion effects by going from front to back, etc..

Imagine the positioning along the length like this:

1 6 4 8 2 9 5 7 3

Each *successive* number is the point of contact.

I think I would still prefer to do this with a conventional iron.

It is possible to solder whitemetal components to brass. Here I tin the brass with a conventional iron with normal solder, then I tin the tinning with low melt solder. The whitemetal component is then positioned and the carbon probe placed *alongside* used to heat the brass allowing the heat to be conducted to the joint. You can see the melt front moving through the low melt solder. Once this has passed the component remove the heat. The cooling time for low melt is longer than normal solders so keep the part located until you are sure the solder has solidified. It is also possible to carry out this type of operation with a normal iron (75W!) placed to heat the joint indirectly. This is the only time I will use an acid flux, just enough to wet the joint between the parts.

__Remember!__

Keep the carbon tip in good condition.

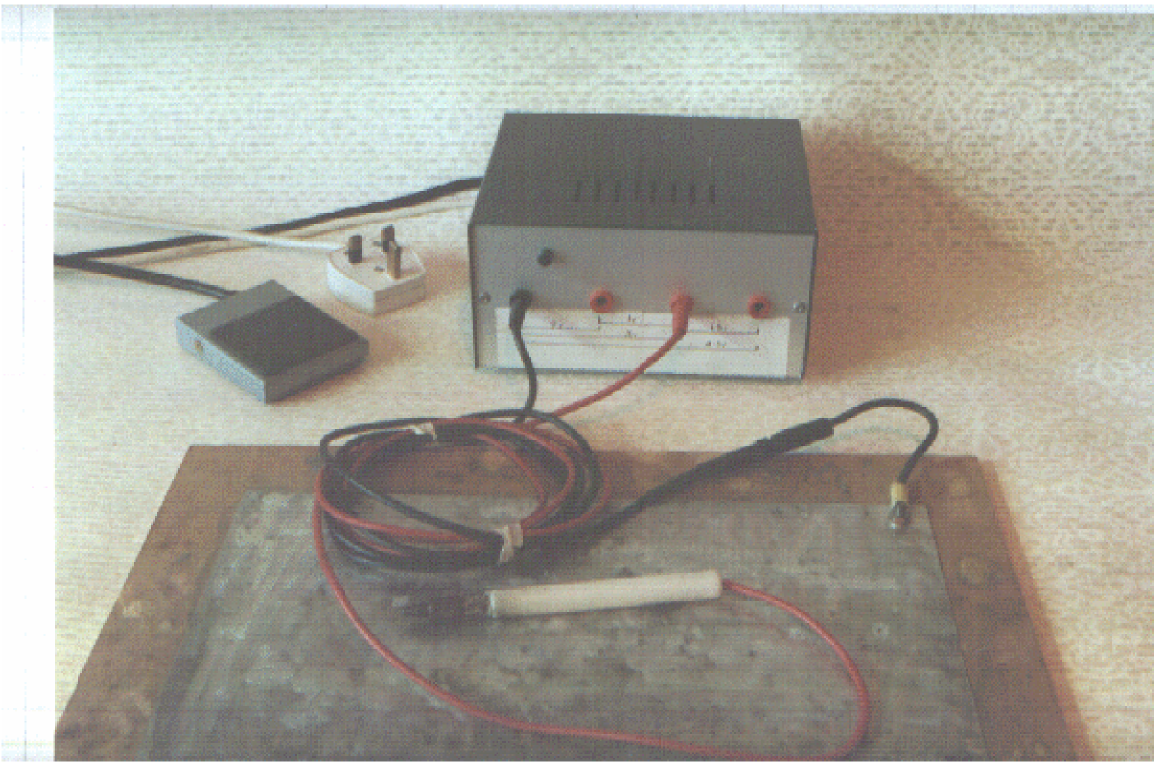
Start with a low energy level and build up to the one that works.

Beware! When operating in confined spaces, the metal parts of the carbon holder can touch another part of the model and arc across.

For large or long pieces distribute the energy application.

__Sources of RSU's__
FourTrack Models
Exactoscale
Dick Ganderton

__Sources of tools and materials.__
The Tool Box
Squires
KS Metals
Carr's



__FourTrack Models ex-London Road Models RSU.__
Power box, foot switch, cables, probe and contact plate.
Power level markings are my own addition. A label is now supplied.

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