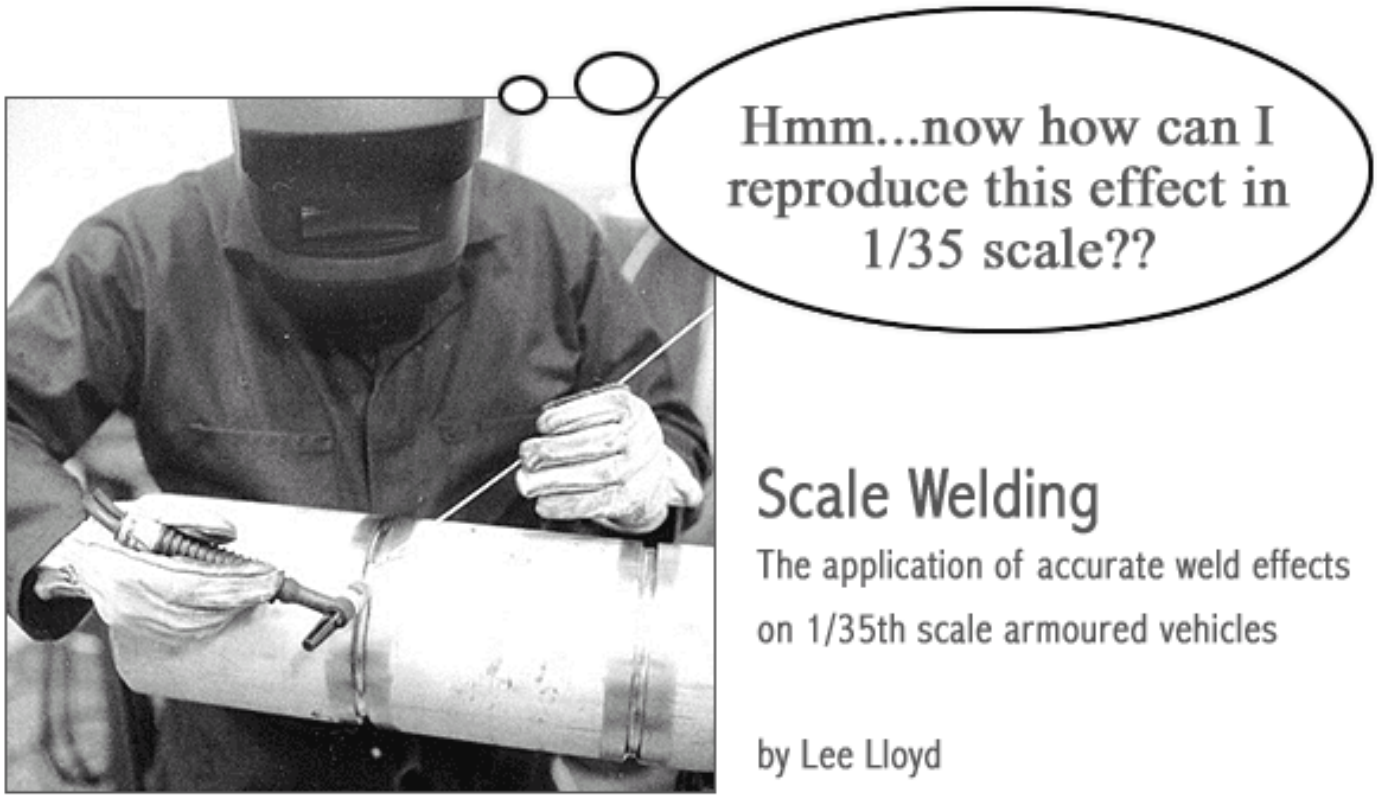
How to Create Accurate Weld Effects
by: Lee Lloyd



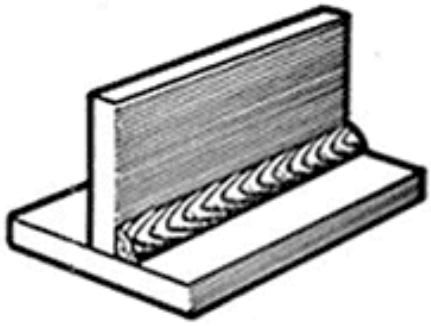
Introduction

This article is a culmination of ongoing work that has been carried out on a modelling project as well as numerous discussions on the same subject at the Tyneside IPMS UK model club. In this work we shall describe one technique that has been developed to replicate scale welding based upon real-life methods of welding processes. We shall describe the tools and materials used for such work and then illustrate in practice both some simple and complex examples of scale welding. The article will be finished with a brief description of other methods, both scratch building and aftermarket products that can also be used to replicate such effects.

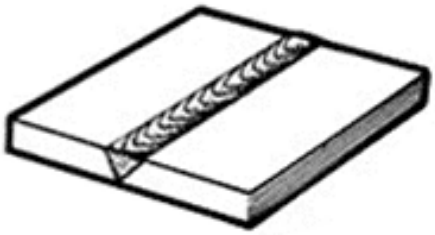
Basic Welding Techniques

Virtually all types of welded joint are classified into two major types:

Fillet Weld
A Fillet weld is roughly triangular in cross section between two sections that are not in the same plane.



Butt Weld
A Butt weld is a weld between two sections in the same plane.

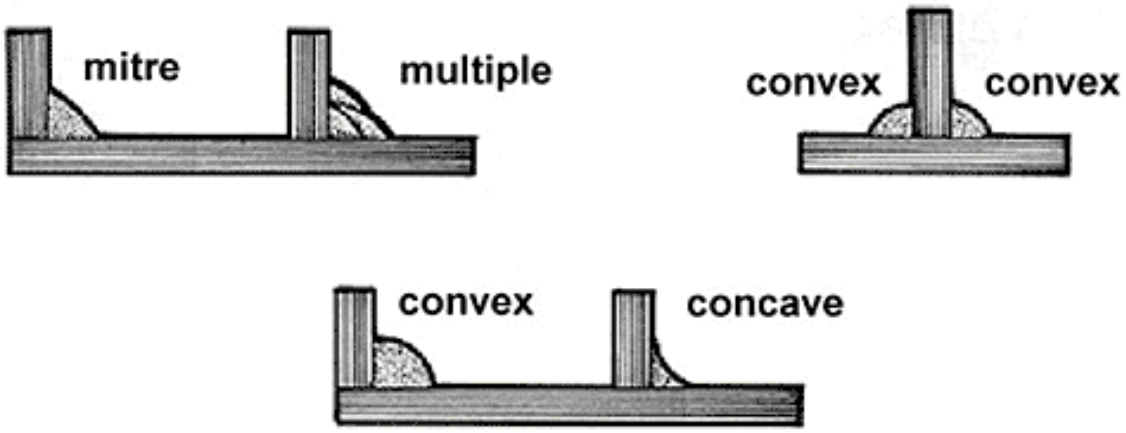


Other weld types often referred to are lap welds, corner welds, edge welds etc but basically these are just variations of the two weld types above. Note that in our work here we are not concerned with the physical process of welding but only the visual product that remains once the welding process has been completed.

In all cases of replicating weld seams some thought must be made prior to actual application as to what kind of effect we are trying to achieve. This must take into account the materials to be welded, the circumstances under which work would have taken place and the skill level of the welder. Whilst the latter three points may seem a bit excessive to be concerned with, if you are trying to make your scale welds as accurate as possible they should be considered. With respect to materials and armoured vehicles we are usually looking at either the welding of armour plates or on-vehicle accessories. The welding of armor plates is usually done under factory conditions with skilled personnel. This should mean that welded joints are very uniform and neat; i.e. the welding of armour on German tanks especially in the early years of World War 2. This can be contrasted with the skill level of Russian welders of the same period whose main tasks were not necessarily to do things perfectly but instead to complete them fast. If you look at welds on Russian vehicles of this period we can see on average that the weld quality on AFV's was of a very mixed quality. As the project work to be carried out here is on such a Russian vehicle of this time period we will attempt to show weld effects of both good and poor quality.

Some examples of weld joints that can be easily replicated and are relevant to all types of vehicles of all time frames can be illustrated below.

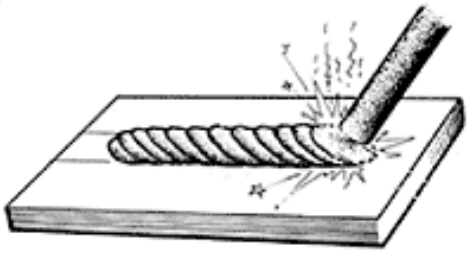
Fillet Welds



Butt Welds

The Tools to Be Used

So how can we replicate such effects? We need a set of tools. In our case our welding torch will be a set of hand made brass formers, our weld beads will be milliput and our section to be joined will be the plastic, brass sections etc of our kits.



In order to make a tool that can simulate the look of a weld bead we have to identify exactly what such beads look like. If we look at the diagram to the right we can see how a weld is formed. It should have the look of a number of evenly spaced ridges that have a half moon shape and that run a distance with constant width.

A finished and very neat weld seam can be seen in the photo to the right. This is the purest form of welding we would like to achieve but as we will see this type of effect is far from what is often seen on fighting vehicles. The kind of results we will replicate will be ‘rough and ready’ but in keeping with the vehicles of the time.

The tools to be used to create such effect should therefore be capable of creating a half moon shape when applied to our welding material. To create such tools we need to use a number of brass tubular sections, in our case K&S brass tube was used in a number of small diameters. It is best to make a number of such tools from as many varied diameters of tubing that can be obtained in order to make welds of different widths.

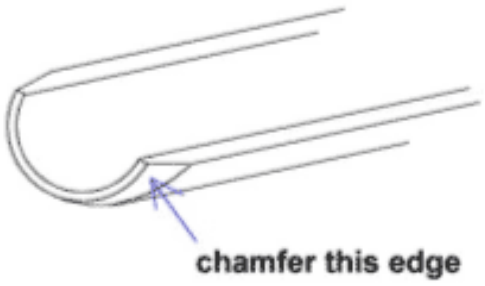
Making the Tool

To create the tool we need to perform the following steps.

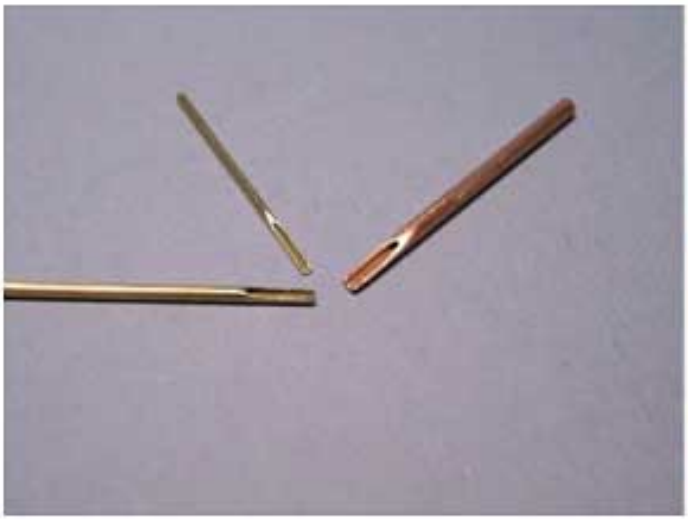
Stage 1:
The shaded portion of the tube above needs to be removed. This can be carried out with a standard flat face needle file but care needs to be taken especially when dealing with the very thin diameter tube sections. The end result should look this.

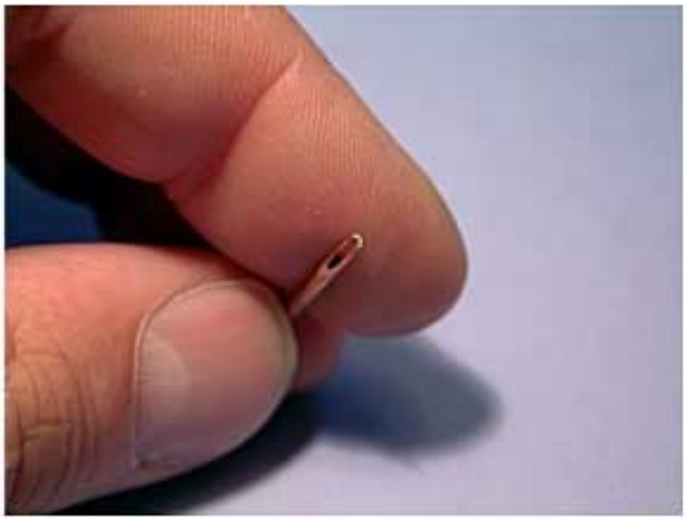
Stage 2:
Round off the edges of the semicircular edge of the tube by removing the shaded blue portions above, this should result in the tool shape.

Stage 3:
Depending upon the thickness of the tube being modified you should chamfer the tool edge to ensure that the weld edge is as sharp as possible. This is illustrated below:



With the final resulting tools being developed as below.





For the weld seam itself I always use superfine white milliput. I have tried other materials, most recently Revell Plasto putty, but in most cases I have found the cohesive consistency of such materials in small quantities to be very poor. When using Milliput you can roll this material to very thin diameters provided you keep the material wet. I mix my Milliput and roll it on a wooden table top in a pool of water and with a bit of care and attention can roll out >1mm diameter lengths of putty. I have found once you have created a desired putty diameter you have a relatively short working time as in such small quantities the Milliput tends to dry out quite quickly.

Once you have your Milliput welds lengths it is a simple matter to ‘drape’ them around/on the unit to be welded. Make sure when you do this you keep you applicator (fingers?) wet as in such small quantities the Milliput has a fantastic ability to stick to anything other than what you want it too!

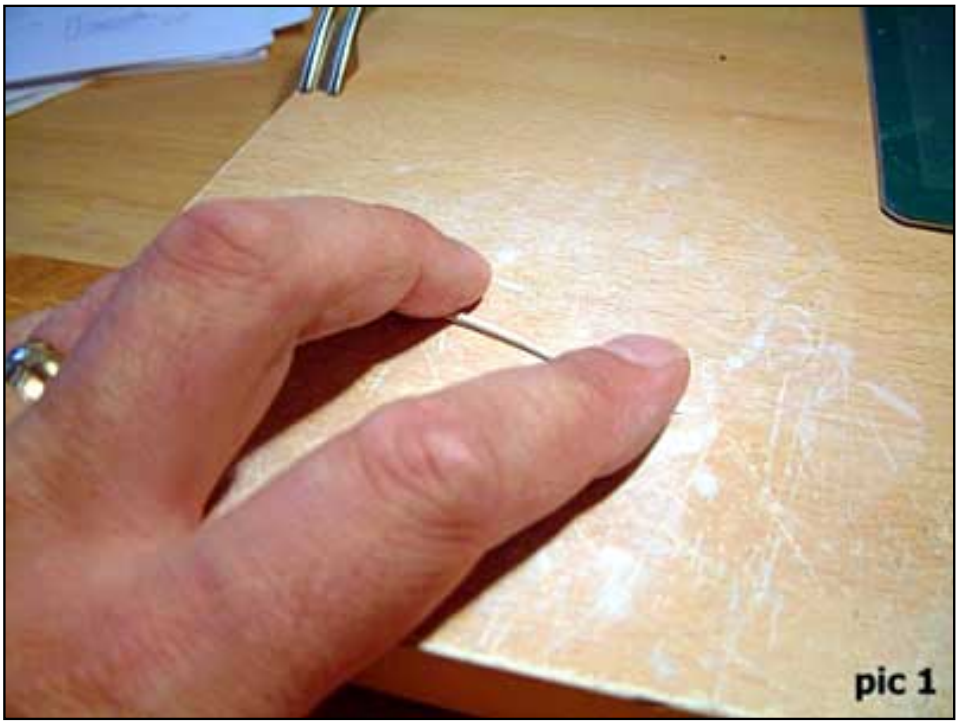
For the sections to be welded a certain amount of preparation is also necessary. When making a fillet weld there should really be no modifications made to the sections as the putty can be applied directly at the desired location. If a butt weld is to be made it is best to score the surface as per the weld example pictures so that the weld can be built up properly and does not stand too proud of the sectional surfaces when finished. A good tool for creating such scribed lines is a panel scriber of the type seen here. This tool has a reverse cut blade that creates cut lines that leaves no burs in a plastic surface. I understand that aircraft modellers also use this type of tool frequently for re-scribing panel lines on aircraft. By creating a groove into which the putty can be set you are guaranteed to keep the putty in place while making your weld seam.

Basic Welding Simulation

Now that we know how to make our weld seams let us put the practice into theory. In this section we shall make some simple welds.

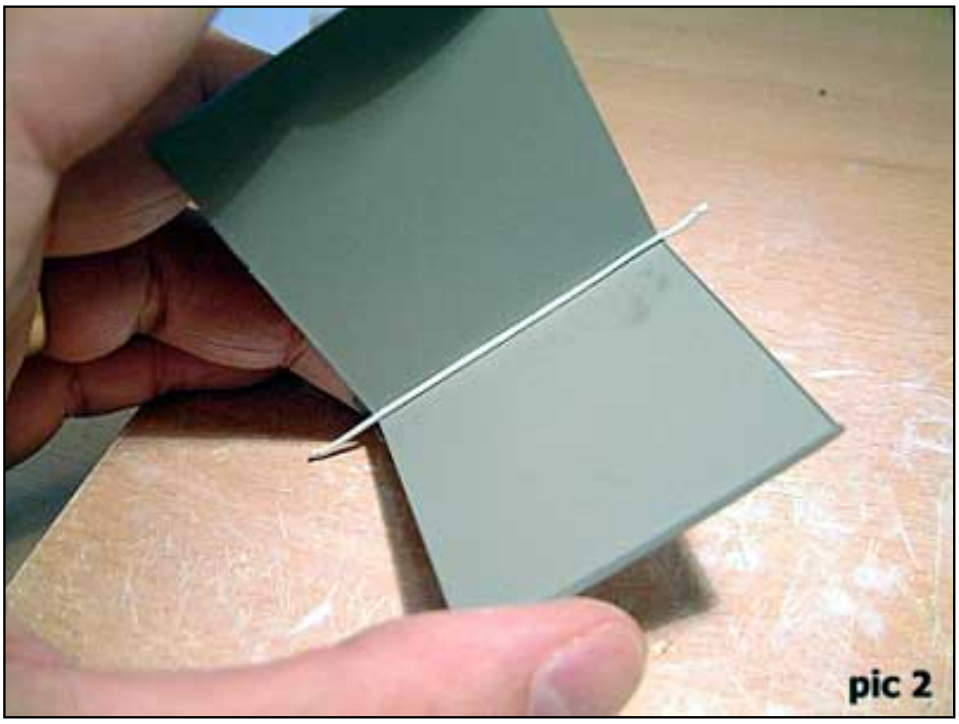
Example 1: 90° fillet weld (convex)

This is the simplest type of weld to make. In **Pic 1** we can see the rolling out of milliput to very fine diameters – the secret is at all times to keep your fingers, milliput and work surfaces wet! In this image the weld is currently about half the final diameter that we require to do our work.



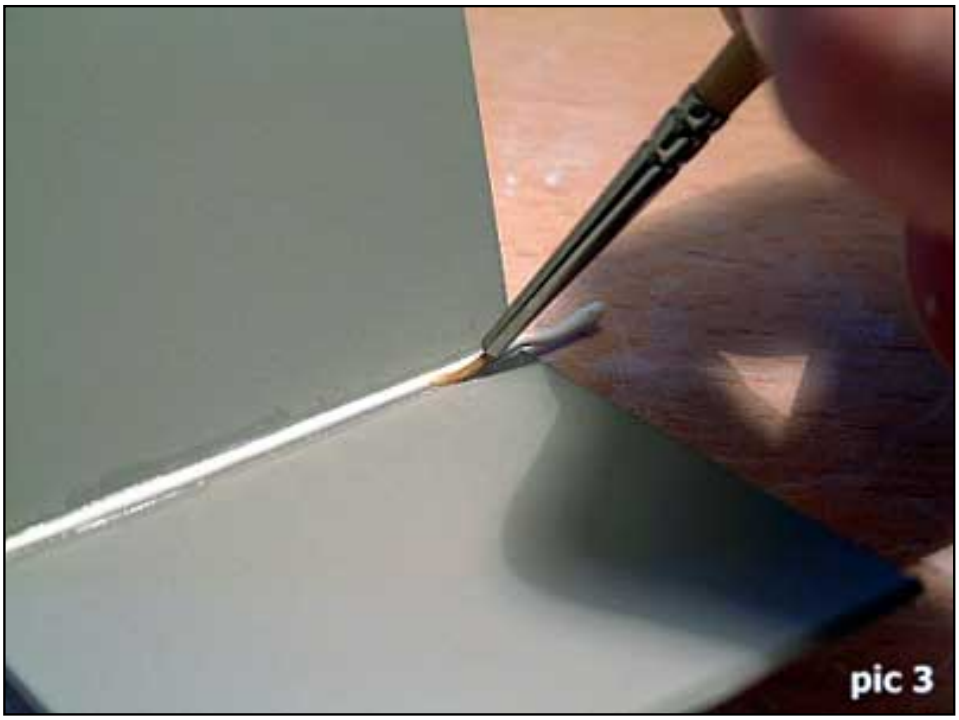
Pic 2 shows the templates that we will use for our weld examples, basically they are squares of styrene covered with a grey primer in order to make a good photographic colour contrast.

To lay the weld we wet with a paintbrush the corner groove that we are to use and then lay the milliput roll into that same space.



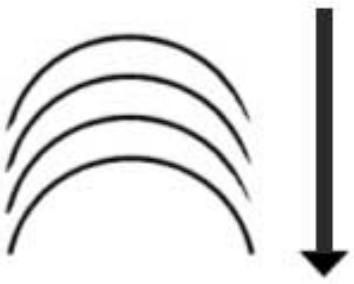
Now that we have the weld roll in place we must cover the area in water. This will serve to blend the edges of the milliput to the sectional surfaces as well as providing a medium that will prevent the weld tool from sticking to the milliput. Let the milliput harden for a few minutes so that a surface skin forms before applying another

small amount of water

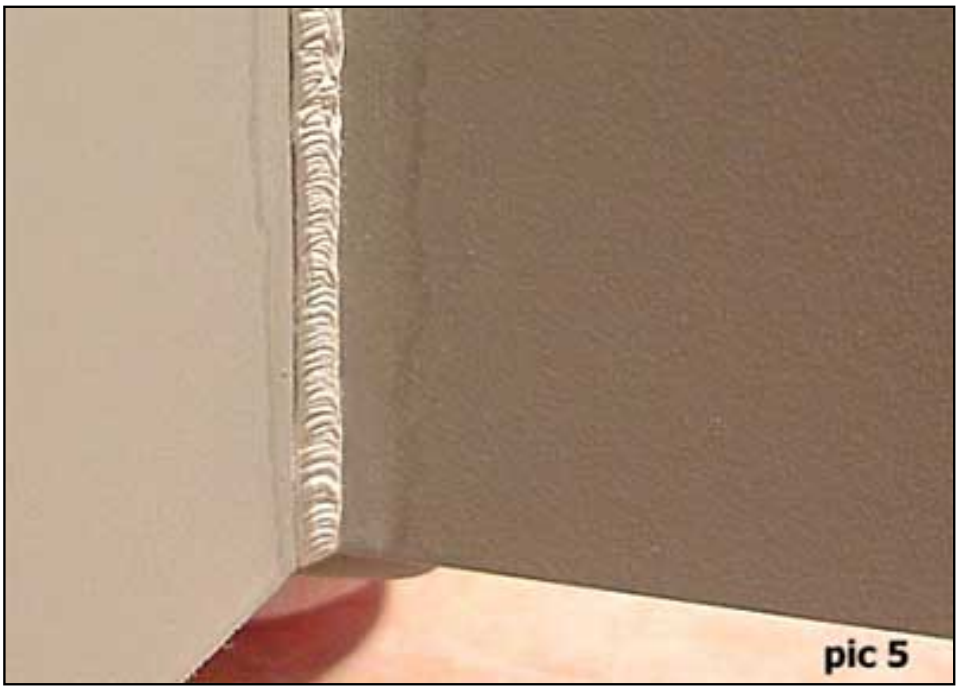


In **Pic 4** we can see the weld tool in a pin-vice before application to the milliput surface. To create a convex weld we use the OPEN end of the groove in the tool, facing the weld, and then sharply jab the tool repeatedly, but not deeply, into the surface of the milliput. What we are trying to achieve is a ridged effect that is semi-circular in shape but that does not penetrate completely the milliput. Always draw the tool down the weld, i.e. as in the direction of the arrow as shown to the left as this will create the correct overlapping nature of the weld. It is VERY important to keep the end of the tool wet when welding otherwise the milliput WILL lift from the surface.

Detailing Tip:
When creating such welds I always use a monocular eyepiece (x10) as I find that this allows me to examine the work very closely and allows fine welds to be created.



In **Pic 5** we can see the finished weld before a final blending of the edges with water and a paintbrush into the sectional surfaces again (application of the weld tool will always tend to move the milliput around regardless of how careful you are). In this image you can see how certain areas are tidy, others are rough and downright messy, but overall we have an accurate 3-dimensional fillet weld. The look of the finished weld is purely up to how you want you work to look again depending on the time frame and type of vehicle/weld being simulated.


pic 5

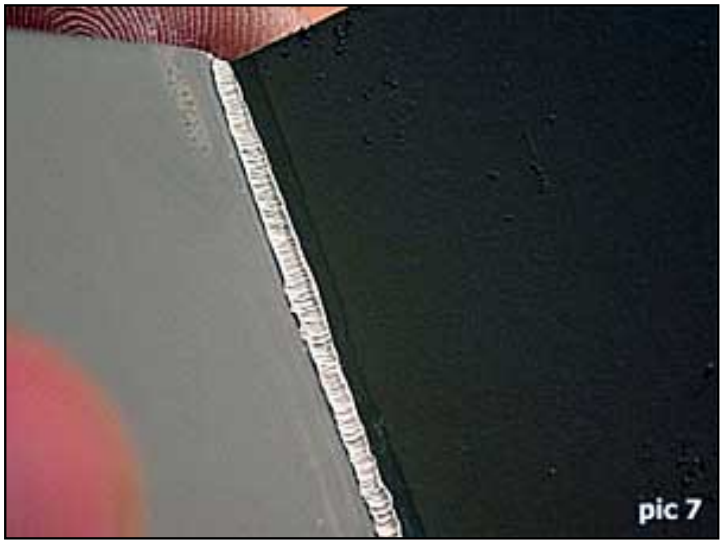
Example 2: 90° fillet weld (concave)

In our next example we shall perform the same process as described above but this time we shall replicate a concave weld. The same process for creating a roll of milliput and priming the sectional surfaces with water is as previously.

In this case though instead of blending the edges of the milliput into the adjoining areas, we force the milliput into the corner surfaces as smoothly as possible. This we have done here by the use of the end of a paintbrush. Once we have the milliput in the shape we desire we must once again wet the surface and leave to allow a skin to form.

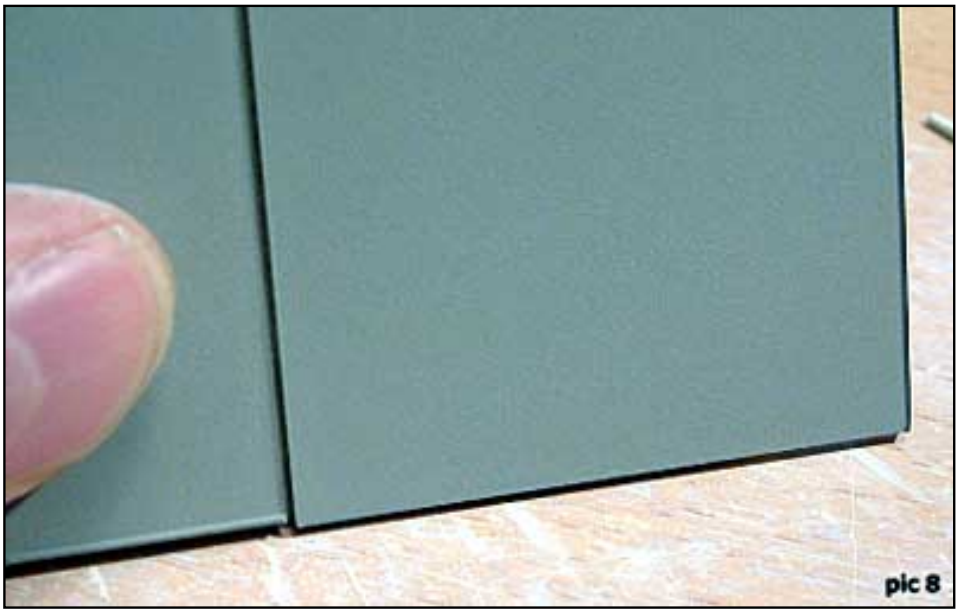

pic 6

To create the weld seam in this case we must use the CURVED back edge of the weld tool. This is used in exactly the same manner as in the previous weld but in this case we will leave our ridges in a concave shape. This is illustrated in **Pic 7** before the final blend of the edges into the surrounding sections has been carried out. The image does not show too clearly the concave nature of the final shape of the weld but rest assured this is the exact shape you get. This can be compared to similar welds on vehicles and once painted and washed/weathered will blend in very well with the surrounding detail.



Example 3: 90° butt weld

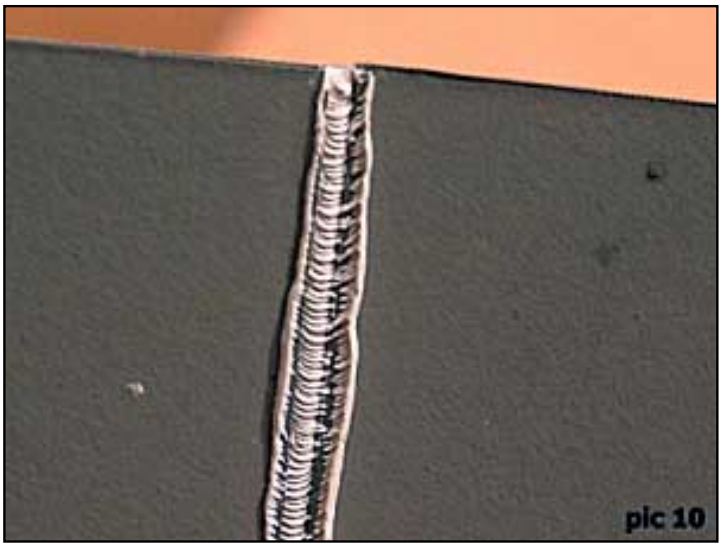
In the last of the simple weld examples we will cover a butt weld. In this case the template to be used is two sections of styrene with a small gap left between them, backed by another styrene strip. Here we are trying to replicate the gap between sectional surfaces that would naturally exist or that has been replicated on a kit using a panel line scriber. This template can be seen in **Pic 8**.



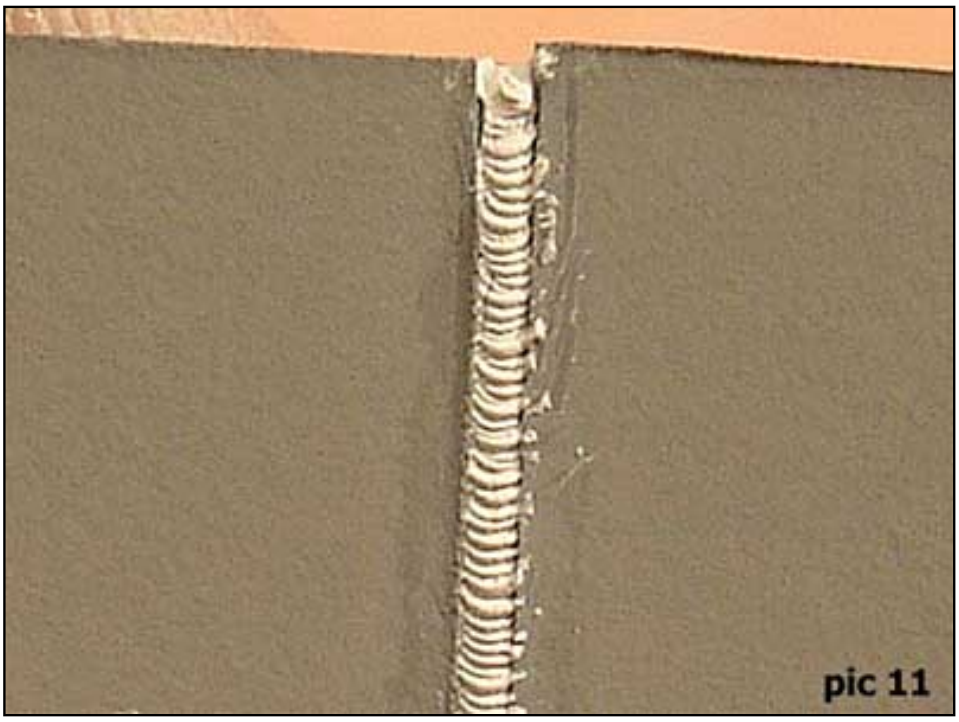
In **Pic 9** we can see the milliput roll has been pressed into our gap between our weld sections. Don't worry if part of the milliput is squeezed out over the edges as this is an effect that we want. Again make sure the surface has been layered with water and the surface left to harden.

To create our weld we use our tool as before using the OPEN end of the tool. This

time we press down through the milliput so that all excess material is squeezed out to the sides. What this should leave is a weld that is at the level of the sections that is being welded and can be seen in **Pic 10**.



What we do next is scrape away the excess material and again with some water and a paintbrush, gently blend in the edges of the weld to the sectional sides. This should leave a weld that has an appearance to that as in pic 11 (Note there is still some edge clean up to be carried out here).



If we then compare the finished butt weld to an example from a real vehicle (in this case a soviet SU100) we can see how accurately this process can be in replicating such effects.

Example image courtesy of TankMaster (www.tankmaster.com).

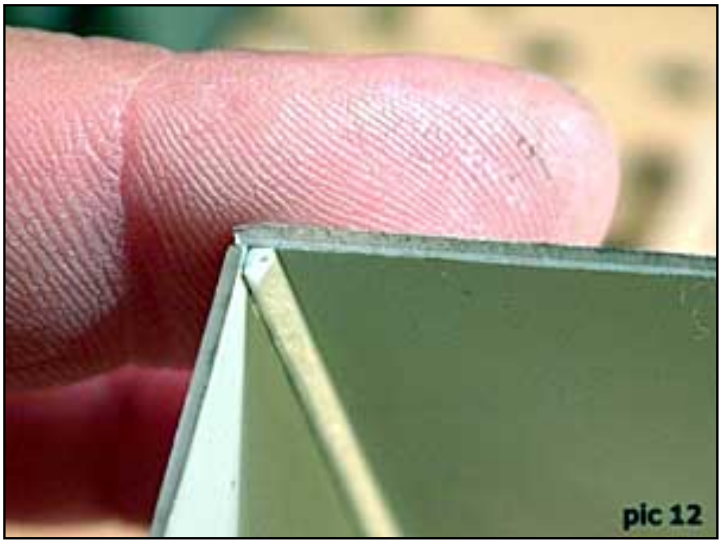
Complex Welding Simulation

In this section we will look at some examples of more complex welding effects. We shall only cover two examples here but the range of effects to be achieved is only dependant upon what the effect is that you are trying to replicate.

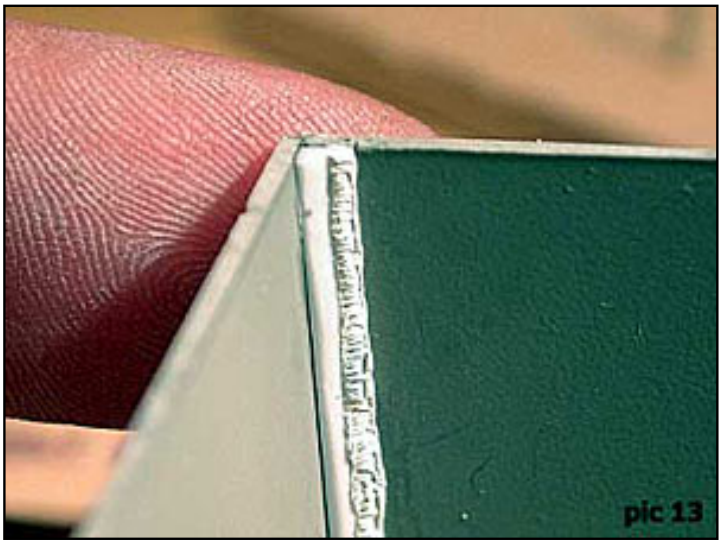
Example 1: 90° multiple fillet weld

A multiple fillet weld is a join that has overlapping weld seams that are designed to give a greater strength between the join of sectional surfaces. The effect that we are trying to replicate here can be seen in our examples as described in the section on Basic Welding Techniques. In our case though we will cheat slightly as we do not need to create an entire series of overlapping welds.

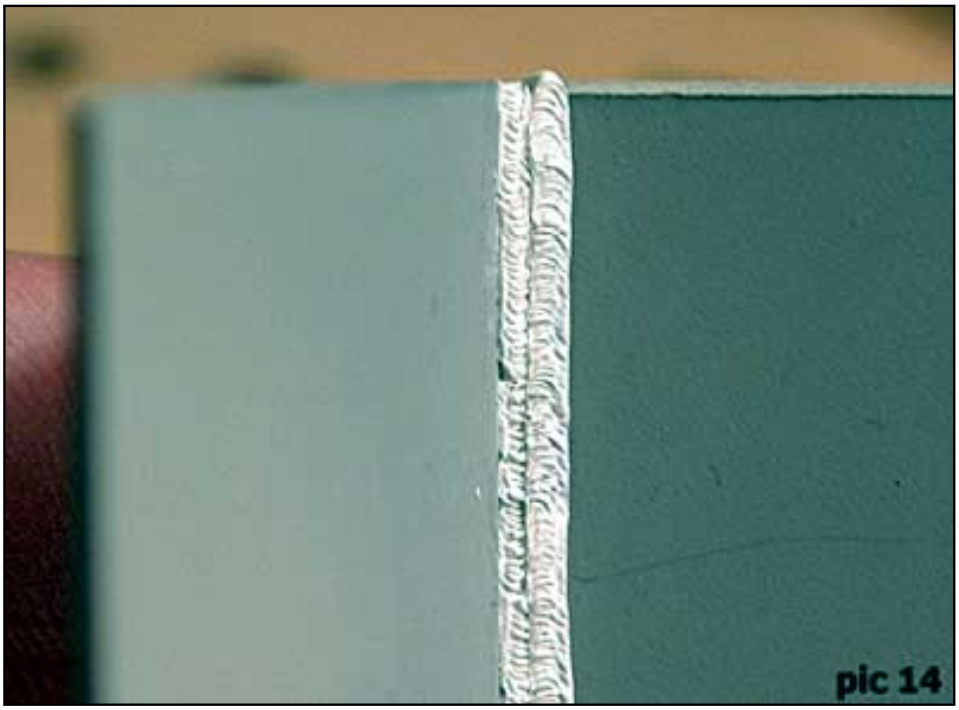
In **Pic 12** we have taken our fillet sections and have added a small strip of triangular styrene directly into the grooved area. This is done to save us time and effort in having to build the depth up using milliput. Note that in this example we are creating a big volume weld. In most multiple weld scenarios you will probably only need overlapping rolls of milliput with no depth filler to create the desired effect



As before the same procedures apply with respect to layering of water on the surfaces to be worked. In **Pic 13** we can see the first layer of weld has been applied along with the surface effects being finished. Blending of the weld to the sections is not done at this stage.



In **Pic 14** we can see the application of a second weld seam. All that needs to be done now is to blend the edges together using water and paintbrush again. Try not to blend in too much the division between the welds where they touch so that you keep a fine line of demarcation. This photo again does not show the volumetric shape that is obtained by this method due to the angle at which the template has been held up to the camera but the general nature of the finished product can be visualised by again considering the shape of the depth area in Pic 13.



Another fine example of what we are trying to replicate can again be seen in the image below (again taken from an SU100). This example shows a nice overlapping but messy effect.

Example image courtesy of TankMaster (www.tankmaster.com).

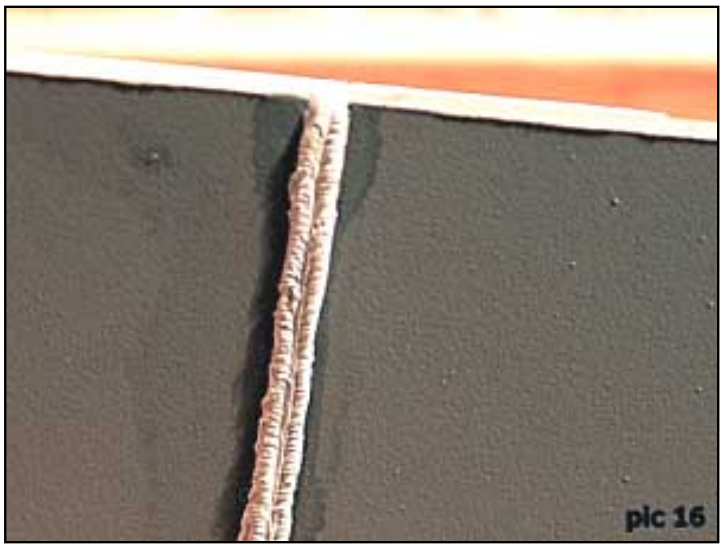
Example 2: multiple butt welds

In this example we shall go one step further and attempt to create a more complex example of welding. In this case we will create a triple butt weld where one weld section has a very different consistency from the others; essentially we will try to create a splatter kind of weld effect.

In the same manner as before we have a butt weld template to which we have already applied a single weld bead (convex), using the methods as described previously, see **Pic 15**. In this example you can see a small run of milliput to the left of this seam. This is a small roll of milliput I added as a base filler as I had made the butt weld sections a bit too far apart!


pic 15

In **Pic 16** we have added the second weld seam. These have layered nicely together but as before no final blending is done until the final weld is added as we do not want to apply too much water which could have the effect of dissolving too much milliput and thus ruining the fine detail on the weld ridges.


pic 16

The next stage is to create a weld seam that has a much rougher surface consistency. In order to make this I have used a product called CAST'a'COAT ® that is available from the Small Shop in the UK. This is a product that consists of sets of granular materials in two grades. The idea behind this product it to replicate the rough surface effects on a variety of materials and surfaces. In order to create a 'splatter' type weld I decided to mix in some of the coarse grained CAST'a'COAT into a roll of milliput before application to the weld area. This can be seen in **Pic 17**.

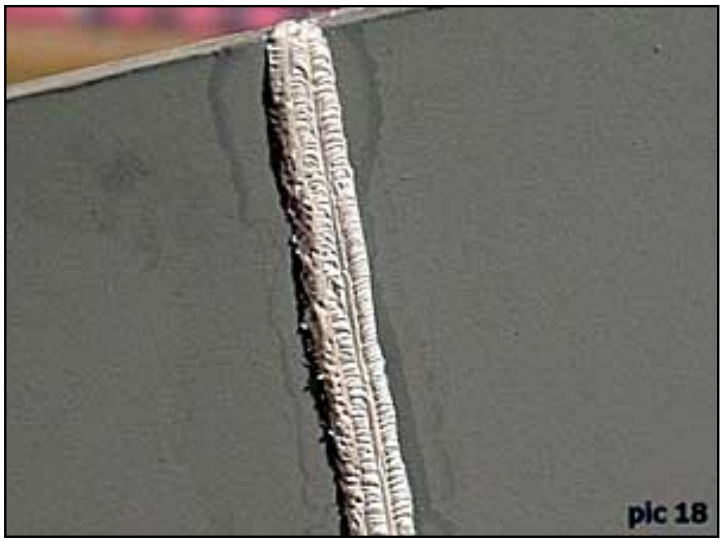
Once this was mixed in, and by this I mean the CAST'a'COAT was rolled into the surface, rolled back into a ball, rolled out again and into more CAST'a'COAT until I had a nice consistency of material throughout the volume of the milliput and not just stuck to the surface.

pic 17

The weld was then applied to the sectional surfaces but this time was detailed with a toothpick as I did not want to create a ridged effect here. The toothpick was gently pressed into the weld surface and a certain amount of material was picked out to the sides in order to simulate a very messy process indeed. The end result prior to water blending can be seen **Pic 18**. The final result looks very rough but even at this stage the splatter weld has a very rough feel to it surface that with correct

painting/washing etc will dramatically bring out the detail.

A good example of the effect I was trying to achieve here can be seen below (again from an SU100). We can see very clearly the triple weld with different consistency effects. In hindsight I should have created the example above actually in the gully of the template I used for this example as it would have shown to much better effect the weld join across the entire flat surface.



Example image courtesy of TankMaster (www.tankmaster.com).

Other Methods for Scale Welding

This article has covered one method for accurately replicating weld seams on scale military vehicles. Of course this is not the only means to do this and other methods exist in common practice that includes both aftermarket products and other scratch-building processes.

Stretched Sprue/Styrene

Perhaps the most common alternative method for replicating weld seams is to use the stretched sprue/styrene approach. In this method a circular section of styrene or plastic is heated or bent to fit the shape of where a weld seam is to be made. An application of liquid styrene glue is applied to the parts to be welded with an amount of his glue being applied directly all over the surface of the weld bead. Once this glue has significantly melted/softened the weld this part can be detailed by using knife blades, toothpicks etc.

While this method does work I have found that it is very difficult indeed to get an accurate pattern to form on the weld as the material never resolves to the correct surface plasticity as is required to work with. You either find that the weld is still too rigid to surface detail or in fact becomes too soft and will hold no detail. I have tried this method using the weld tools I have created but could not correctly replicate the ridged effect of a weld.

Pyrogravure

The use of what is really a low-temperature soldering iron is another method for creating weld seams. In this case the pyrogravure is actually applied to the surface of the kit (which may also be previously applied stretched sprue) and is used to 'melt' tiny areas to get the desired effect.

I have never tried this method but have seen some very nice but also very bad results from using this tool. What you have to remember is that in modifying the actual surface of the kit you are changing the surface volumes into shapes that are not meant to exist – i.e. the melted material is not removed but is pushed to one side. This can result in raised areas that do not replicate real volumes being modelled. Also as the tip of a pyrogravure tends to be round (I am sure a tip the shape of a tool described here could be fabricated) when welding you will not achieve a ridged effect in your work.

In summary as I have said I have seen some very good results produced when using both of the methods I have described above. However in my never ending search for accuracy in my work and in the interests of realism I have not found these methods generate the effects that I desire.

Aftermarket Goods

Two products that exist as aftermarket products are from ABER and Archer Transfers. From ABER you get a very fine fret that has a number of weld seams that can be used for various effects. I have seen these and do not really care for them as the patterning on them is too regular and repeated and the runs tend to be of too constant a width.

With respect to the Archer Transfers (at the time of writing I am not sure if these products are still actually available) these are designed to work by creating a slightly raised surface once applied so that when painting & weathering they can be made to stand out. Again I have seen but never used this product but as above I have found the runs to be too regular in shape. Also their very nature as transfers does not give them enough of a raised 3D shape that is often required when replicating such effects.

A product which we have discussed at the Tyneside IPMS model club that would be of use would be weld seams that are similar to ATAK/Cavalier zimmerit sheets. Very thin sheets of resin could be created with a wide variety of weld effects to replicate much of what we have covered here. It would be nice to see a manufacturer introduce such a product.

Conclusions

Hopefully I have shown here an effective, highly accurate and cheap method for replicating all types of scale weld process seen on military vehicles. The method is simple and relies only on common tools that are available to all modellers and in fact is quite a quick process to replicate one you have carried it out a

few times.