

Class 31 Bogie Instructions

Notes

Please read through the instructions and the following notes before starting construction.

These etches are designed to aid the construction of a fully sprung P4 class 31 locomotive for the newer Hornby model. You cannot build the bogies to any other gauge. They will require the manufacture of a small number of components and you will need some items in addition to what I have included. These can be found in the Materials List below. Both primary and secondary suspension is provided by guitar wire leaf springs. The bogies are designed to reuse the RTR Hornby drivetrains in order to keep the conversion cost down.

Ultrascale P4 Diesel Disc wheels are recommended.

All fold lines are through 90° with the fold line on the inside unless stated otherwise in the instructions.

Everyone has their own soldering methods. I now use a temperature controlled soldering iron with predominantly 145° solder and La-Co paste flux. Given the thickness of the nickel silver involved with this kit I would recommend using a soldering iron of at least 25Ws.

The etching process is not an exact science so occasionally slots can be slightly under etched. Given the thickness of the material it is necessary to make sure that any slots can accept the full thickness of the metal before fitting. If it is necessary to open out the slots I find a Swan Morton 15a scalpel blade useful as it is just about the right width. Mind your fingers though!

Component lists

- 1 - Main frames
- 2 - Frame strengthening plates
- 3 - Frame spacers
- 4 - Bolster guides
- 5 - Washers
- 6 - Bolster
- 7 - Bolster spacer
- 8 - Bolster strengthening plates
- 9A - Cosmetic frame ends (outer end)
- 9B - Cosmetic frame ends (inner end)
- 10 - EE Exhaust port

The kit also contains the following items:

- Horncheeks and carrier tags - separate brass etch
- 12 x 2mm skinny High Level Hornblocks
- 0.010" guitar wire for both primary and secondary suspension

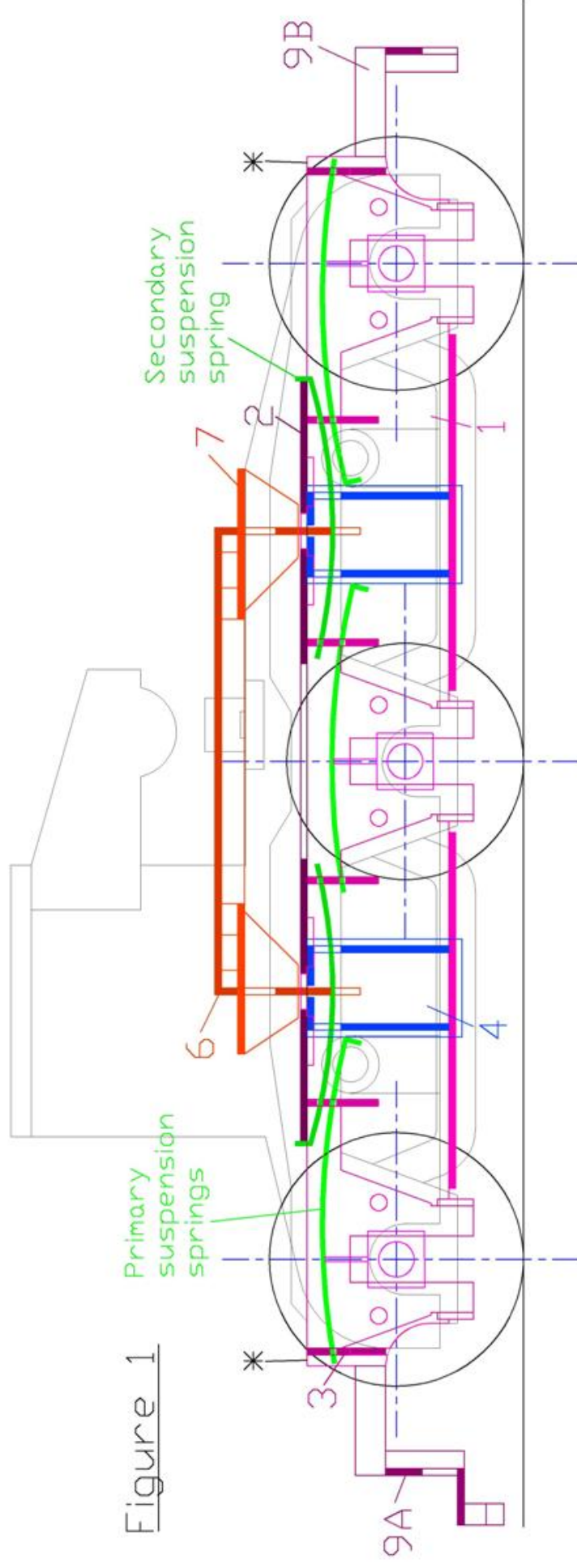


Figure 1

Note:
Cosmetic sideframes align vertically with top of bogie at *

Materials List

The following items will be required to complete the bogies:

1mm wire for use as an aligning pin when soldering the horn guides
33SWG phosphor bronze wire (or similar) for pickups
Thin PCB for attaching pickups

All the above items are available from Eileen's Emporium. Their contact details are as follows:

Eileen's Emporium
Unit 19.12 Highnam Business Centre
Newent Road
Gloucester
GL2 8DN
www.eileensemposium.com

You will also require wire for pickups. I have included recommendations in the Drivetrain Modification section but everyone will have their own ideas.

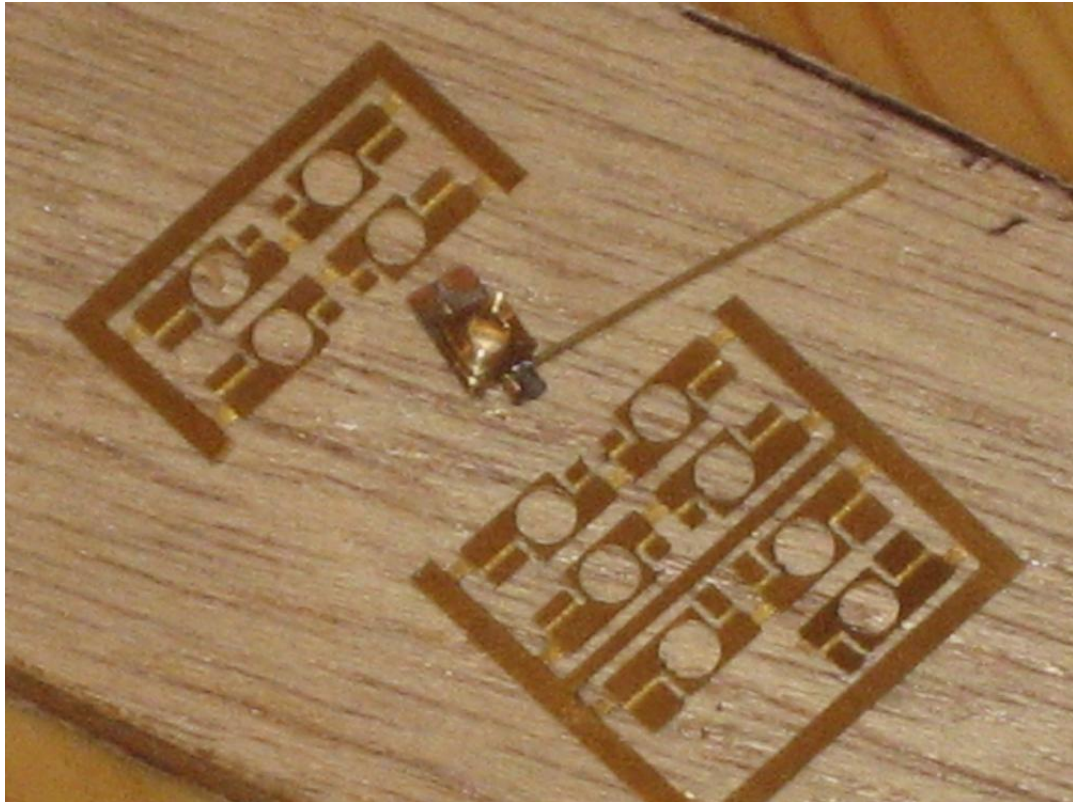
Wheels

The class 31 bogies were a little curious in that the unpowered centre axle had smaller diameter wheels than the outer powered axles. Ultrascale wheels are recommended for the conversion. For the outer axles use 3'7" diesel disc wheels and for the centre axle 3' 3 1/2" Warship wheels will have to be used. Gibson wheels could be used though the quality is not the same and I'm not sure if they would have the correct difference between outer and centre wheel sizes.

Construction

Bearings and Carriers

The first things that need to be addressed are the spring carriers. The bearings will need to be used to tweak the horn guides and so it's a good idea to prepare them before starting on the bogies themselves. There are 12 carriers on the fret which will be sufficient for a 6 axle locomotive. They are designed to be soldered onto the back of the bearing with the small tabs folded out for the spring will rest on. Note that they are handed and there are two lengths of tabs. For the class 31 bogies use the long end. Also note that the bearings themselves, despite being machined from 1/8" square brass rod, aren't always an exact square. One pair of sides is longer than the other. It is useful to arrange the bearings on the spring bearers so that the wider part of the bearing goes across it rather than along it. It is important that you arrange a method of keeping each bearing with its horn guide in the bogie. It's easy to think that because everything looks the same that the bearings are interchangeable. You will inevitably encounter problems if you start to swap bearings around. I know this from experience! My method of keeping everything in its right place is to mark the front of the bogie, I cut a small notch in front end, and then arrange the tabs on the bearings so that they all face towards the front. I then use a piercing saw to cut small slots on the bottom of the bearing depending on which axle it's for. My general arrangement is one slot for the 2nd axle) leaving the 1st, or front, axle plain. Thus for each bogie you can immediately tell where each bearing belongs. I don't differentiate between bogies but make sure that the components for each don't get mixed up.

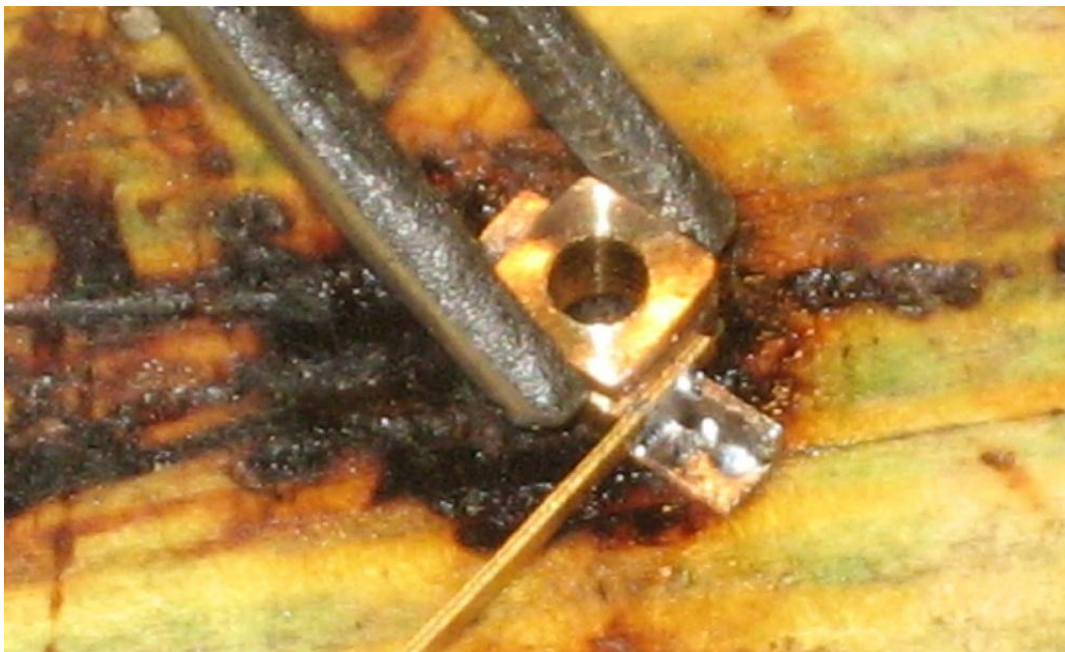
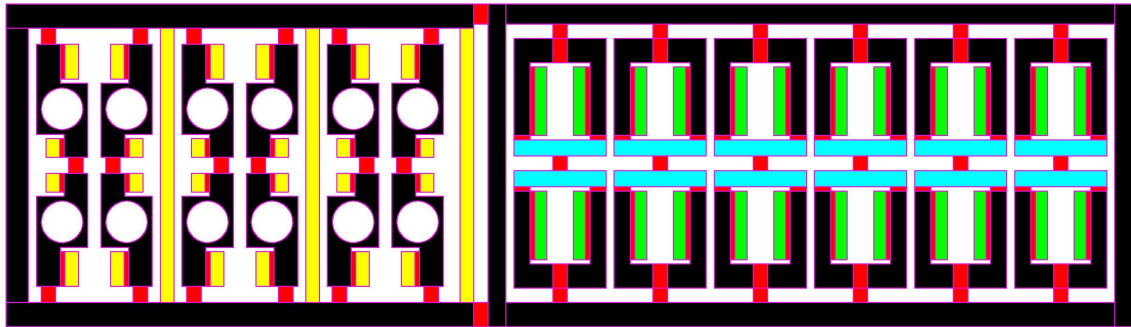


Whilst the spring carriers are still in the fret check that the back of the bearing will fit in the hole. If the fit needs adjusting then do so with a tapered reamer. I tend to assemble the bearings and carriers on a small block of scrap wood with a 2mm hole drilled into it. This will help make sure that the spring bearer sits flat against the back of the bearing. Remove the spring bearer from the fret, fold out the required tab and fit to the back of a bearing. Place the two components in the hole in the block of wood and solder together from the unused end of the spring bearer.

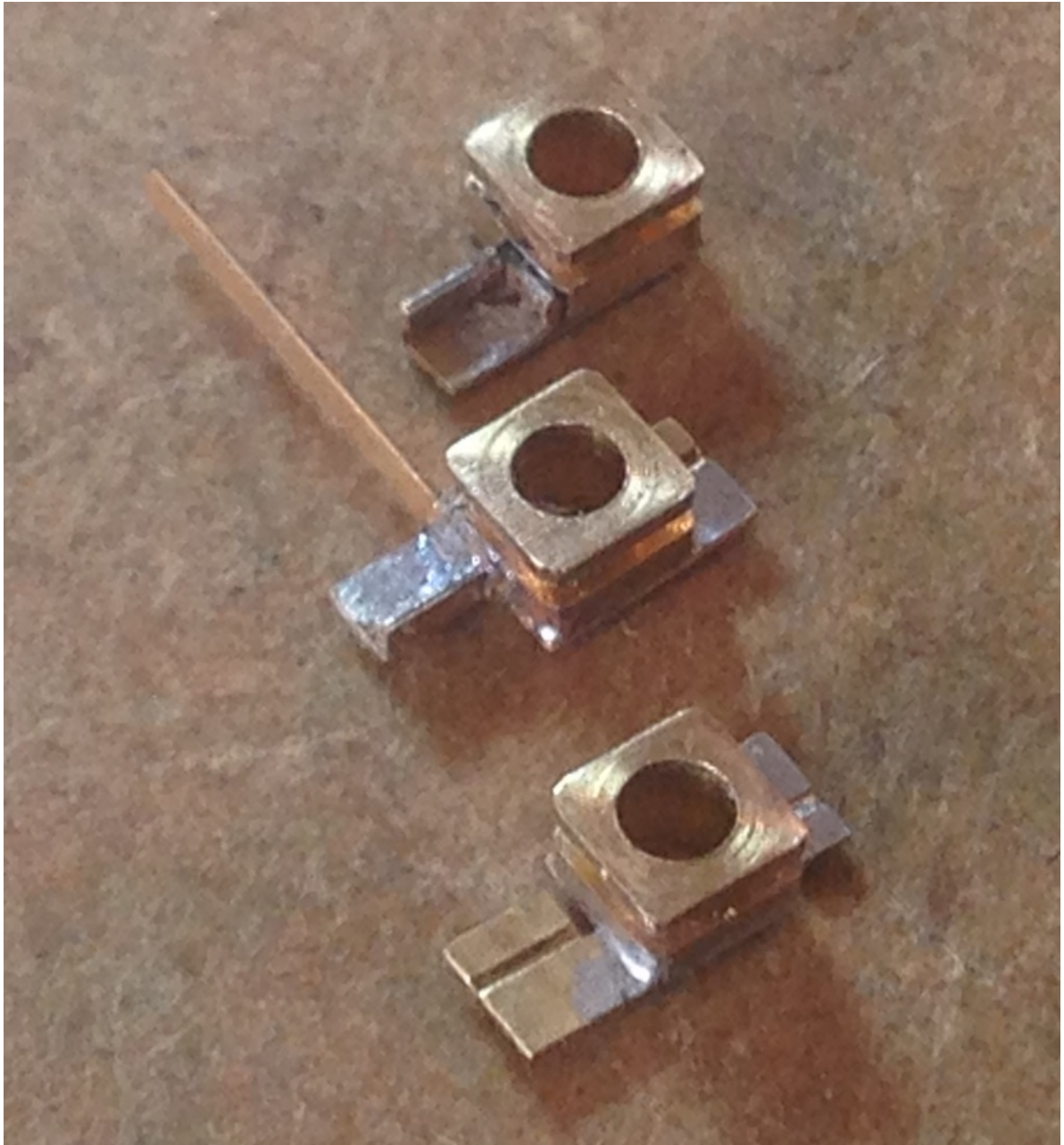


There will be a small 0.25mm gap under the tab which will need to be filled. If you don't fill this gap then the weight of the locomotive will cause the tabs on the spring carriers to bend which could result in the spring wire moving out of position and falling off the tab. I have arranged the spring bearer fret so that the parts coloured yellow in Figure 2 below are the same width. Use these pieces to fill in the gap under the tab and solder in place.

Figure 2



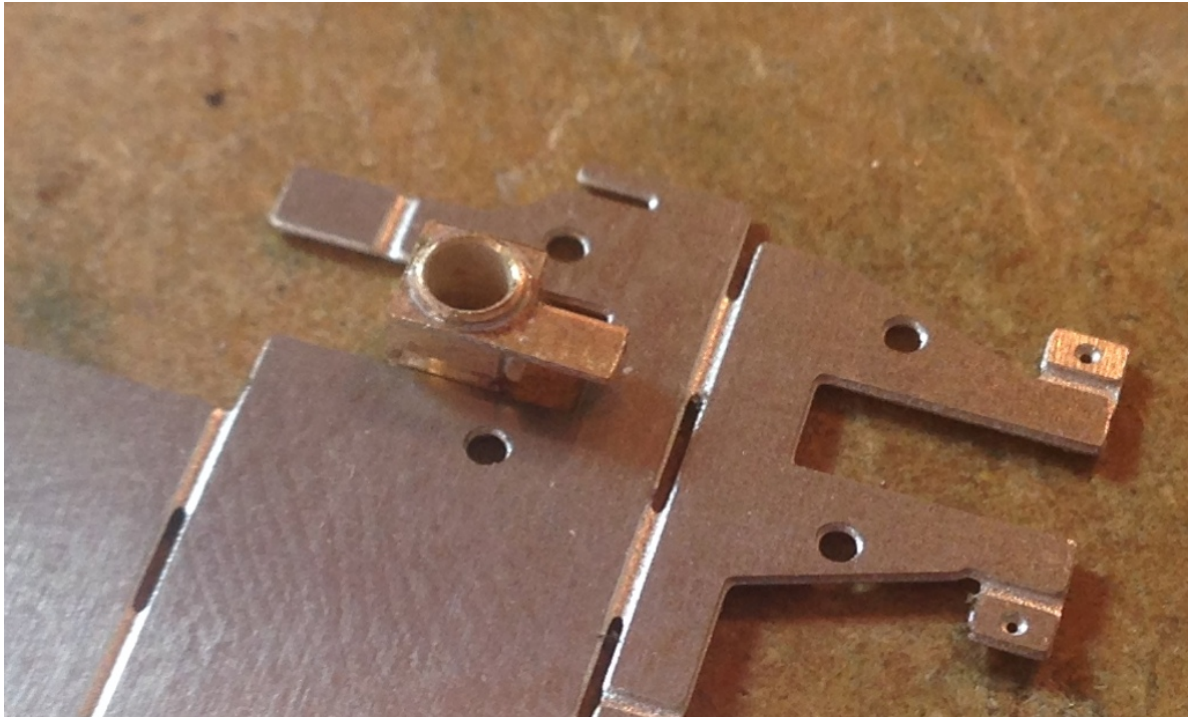
The bearing can now be tidied up. The filling strip can be trimmed and then filled flush and the unused end of the spring carrier needs to be removed and filled flush with the bottom of the bearing. Mark the bottom of the bearing with a piercing saw so you know which axle it belongs to. You will also need to check the fit of an axle in the bearing. I found that the bearings had a small section of swarf at one end that needed reaming out for an axle to pass through. Use a tapered reamer to do this taking care not to enlarge the rest of the axle hole.



Bogies

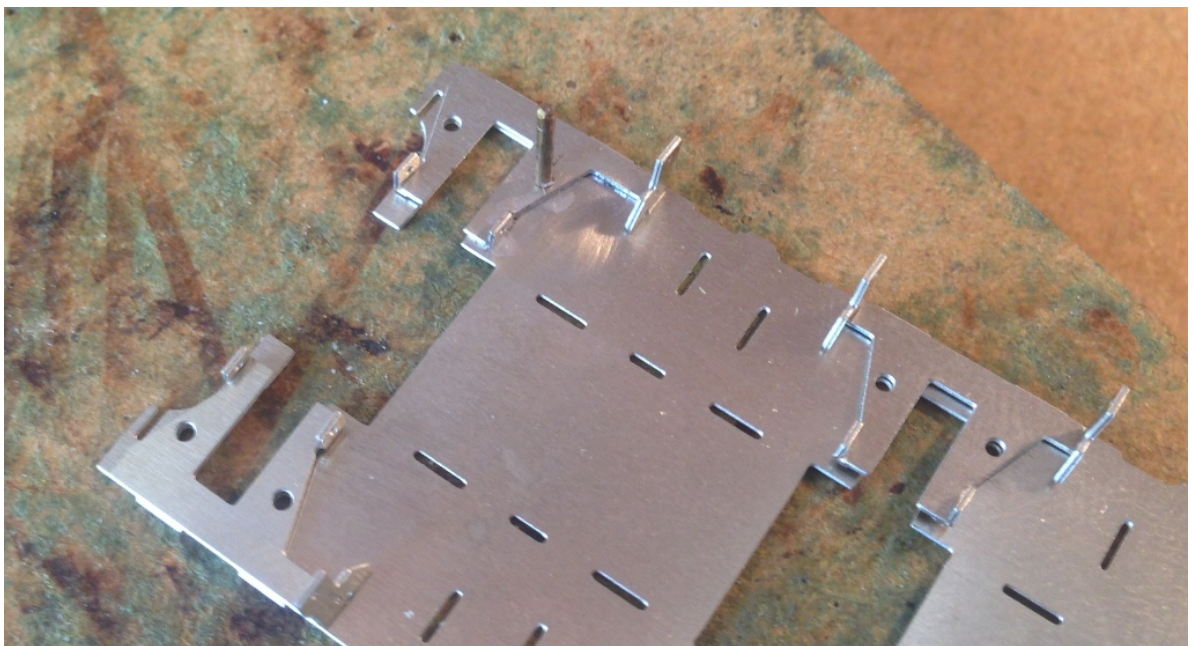
Before starting construction the bearings need to be checked in their guides.

Using a piercing saw mark the front of the main frames (1). The bogies are essentially symmetrical so it doesn't really matter which end you choose at this stage. Once this is done check the fit of bearings in the horn guides on the bogie. There are two different sized slots. The smaller one goes into the slot machined in the bearing and the larger one interfaces with the ends of the bearings. See photos below. The slots may need opening out depending on to what degree the fret has been etched. Use a fine cut file to do this. Work on each axle at a time and open out the slots on both sides of the bogie equally until a good fit is achieved. This should help to keep the holes in the axleboxes aligned and thus the axles square to the bogie. This arrangement doesn't provide a lot of bearing surface area so in the interests of longevity I have included etched horn cheeks. These will be fitted a little later.



Once you are happy with the fit of the bearings in each of the horn guides they can be folded up. They will be folded double and then aligned using a 1mm wire 'pin' before soldering each side together. In order to help with the 'pinning' process it is useful to drill a hole into a piece of spare soft wood into which the wire pin can be pushed after having passed through each side of the horn guides. See photos. I have included a pair of holes on the bogie etches but only one really needs to be used.

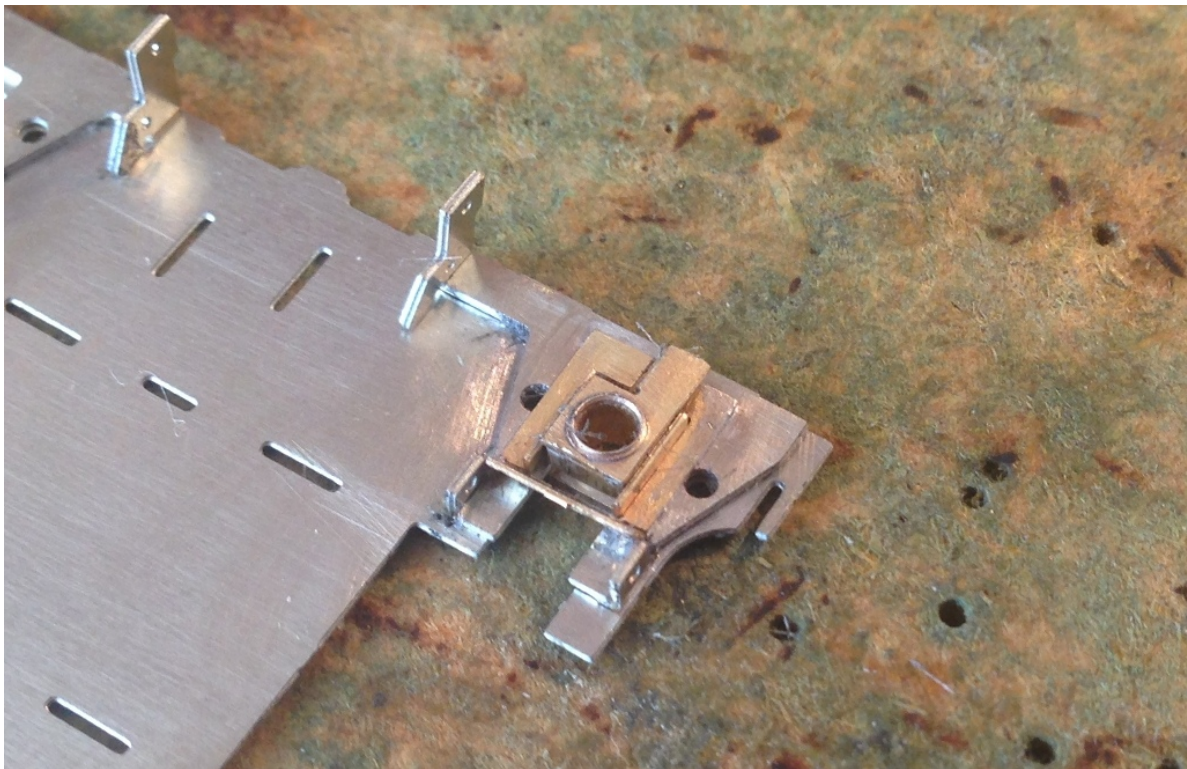
Fold out the fulcrum points for the primary suspension and the tabs for the axle retaining wire. Fold the horn guide double so that the fold between the two sections is through 180° with the fold line on the outside.

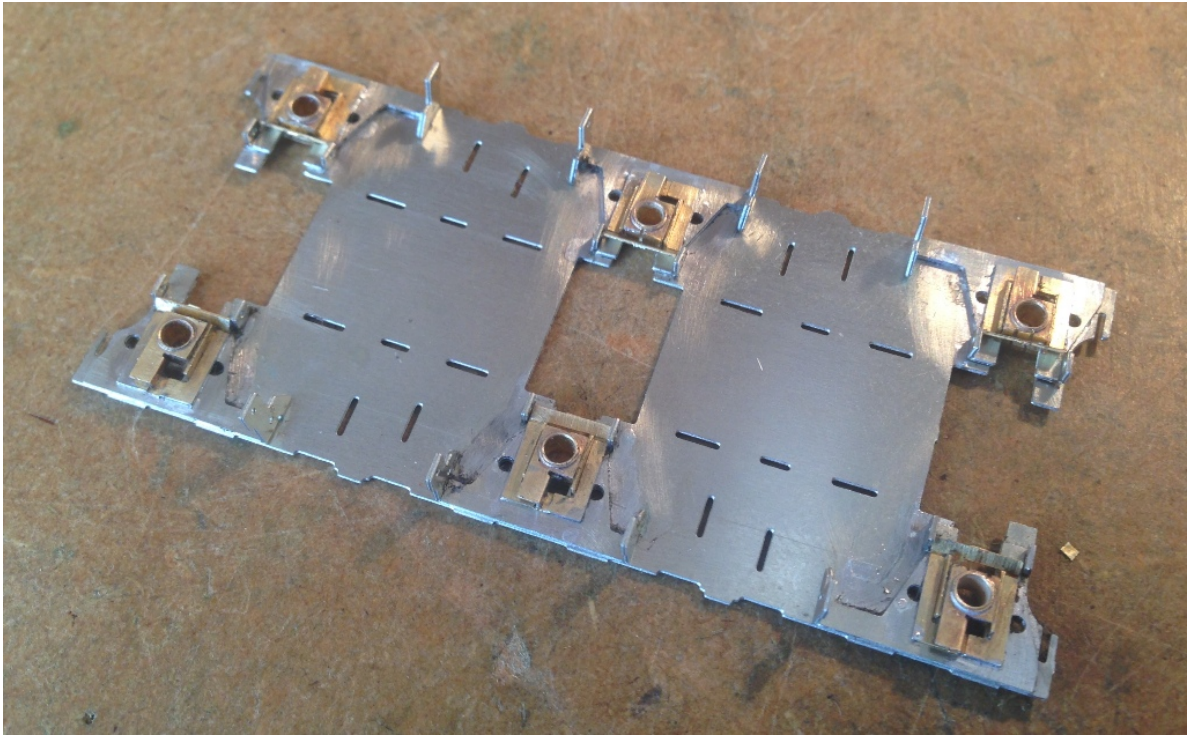


File a taper in the end of a short length of 1mm wire and then pass through the horn guide sections and into the hole in the piece of wood. The holes shouldn't need to be opened out to do this. The wire should be a tight fit. I use a pair of pliers to push the wire through the holes in the etch. If the holes are too small use a reamer to open them out a little but make sure the fit is tight. Solder the two sections of the horn guides together and reinforce the fold lines. Note the fold out tabs at the ends of the bogies when soldering the pieces together, i.e. try not to solder them in place!

The bearings can now be fitted to the bogies making sure they go back in their right places. The use of pins to align the horn guides should have made sure that all the guides are parallel and so the bearings should fit perfectly. If they are tight at all then you can adjust the guides using a fine cut file. Make sure you track down and only relieve the part of the guide that is causing the tightness.

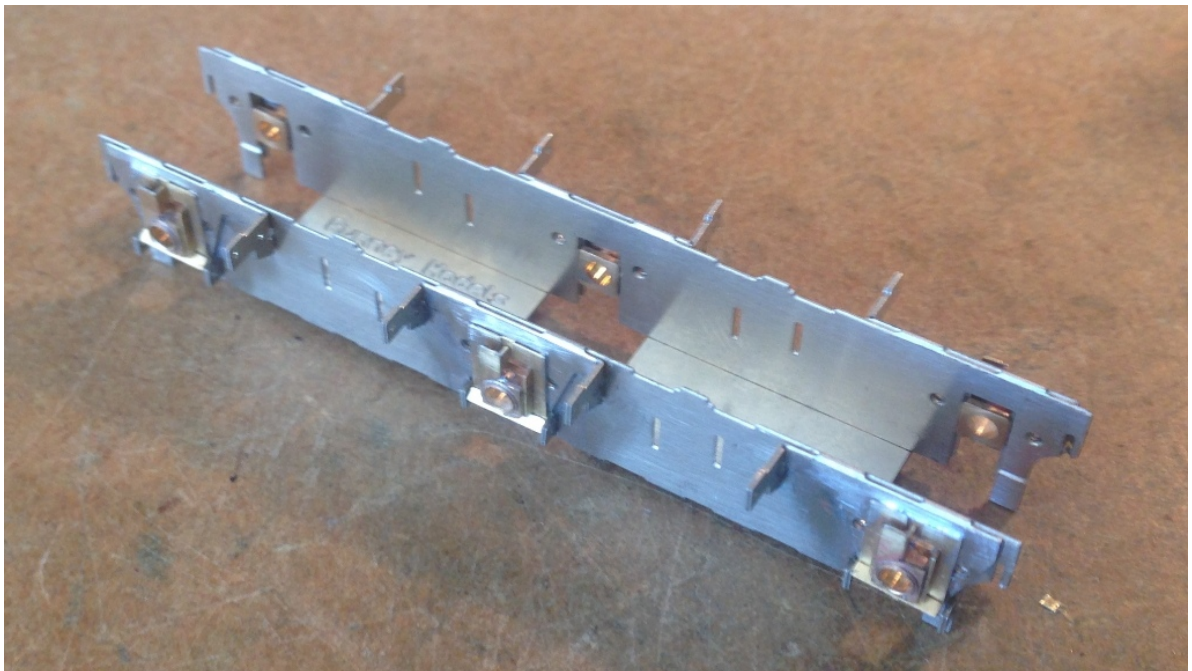
I mentioned earlier that the arrangement of the horn guides as it stands doesn't provide much bearing surface area so horncheeks have been included and now is the time to fit them if you wish to do so. Refer back to Figure 2. Remove from the fret and fold up the actual horncheeks (the parts marked in green). Also fold the section marked in light blue through about 30°. Place the bogie on its side and fit the horncheek etch over the bearing as per the photo below. Check the fit of the horncheeks against the bearing and adjust if necessary. Feed an axle through the two bearings and then solder the horncheeks in place. Once soldered in place the section at the bottom can be removed by folding backwards and forwards until the joint breaks. Repeat for all the other axles.





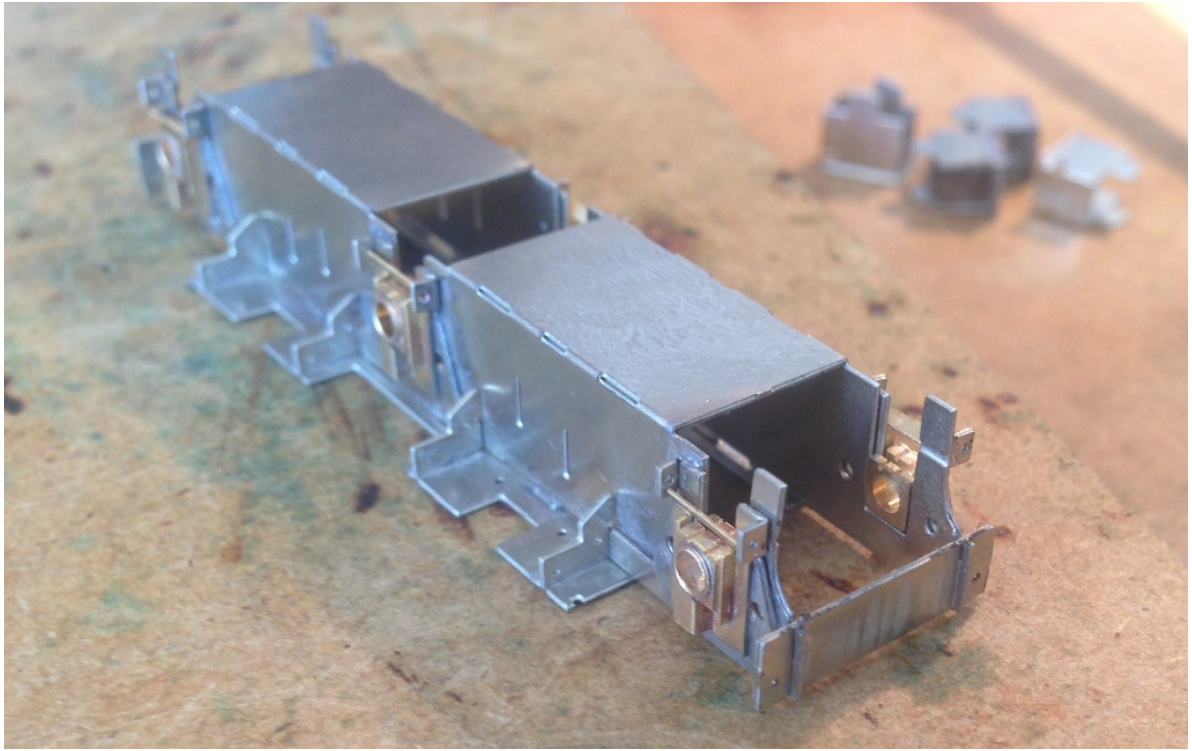
Remove the small tab on the horncheek trapping the bearing in and then use two lengths of 0.4mm or 0.31mm wire can be use to retain the bearings for now.

Now that all the parts of the bogie are in place it can be folded up. Make sure that the sides and ends are at 90°.

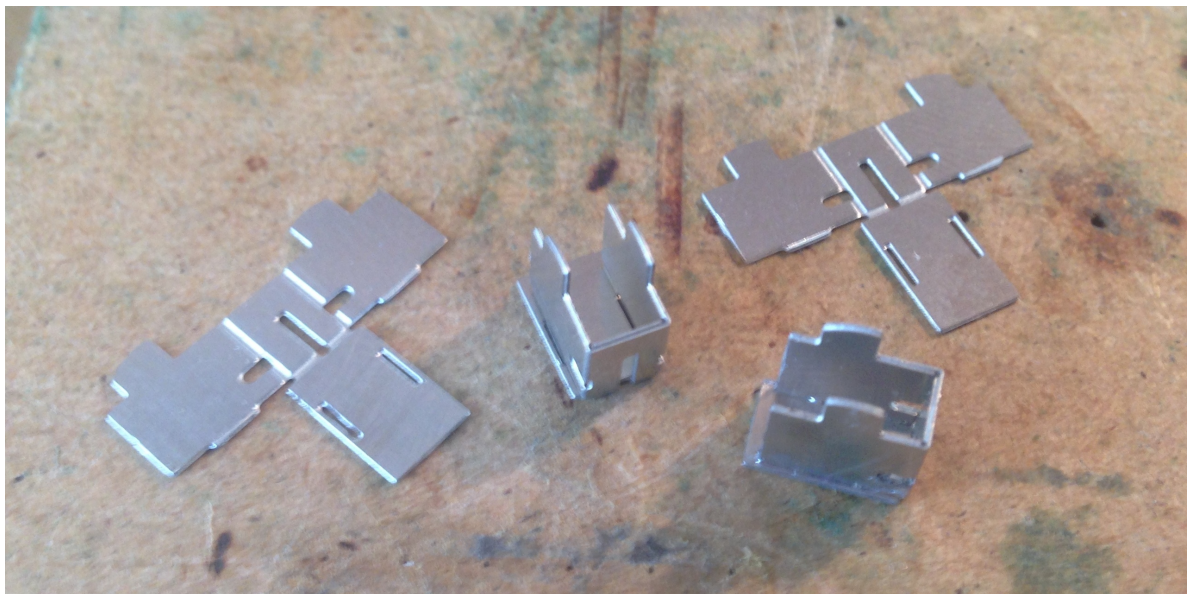


The frame strengthening plates (2) can now be fitted to the top of the bogie. There are two tabs and slots on each side to aid alignment. There are also slots in the strengthening plates to accept the fold out suspension fulcrum points. Make sure that these are in place when fitting and then solder in place.

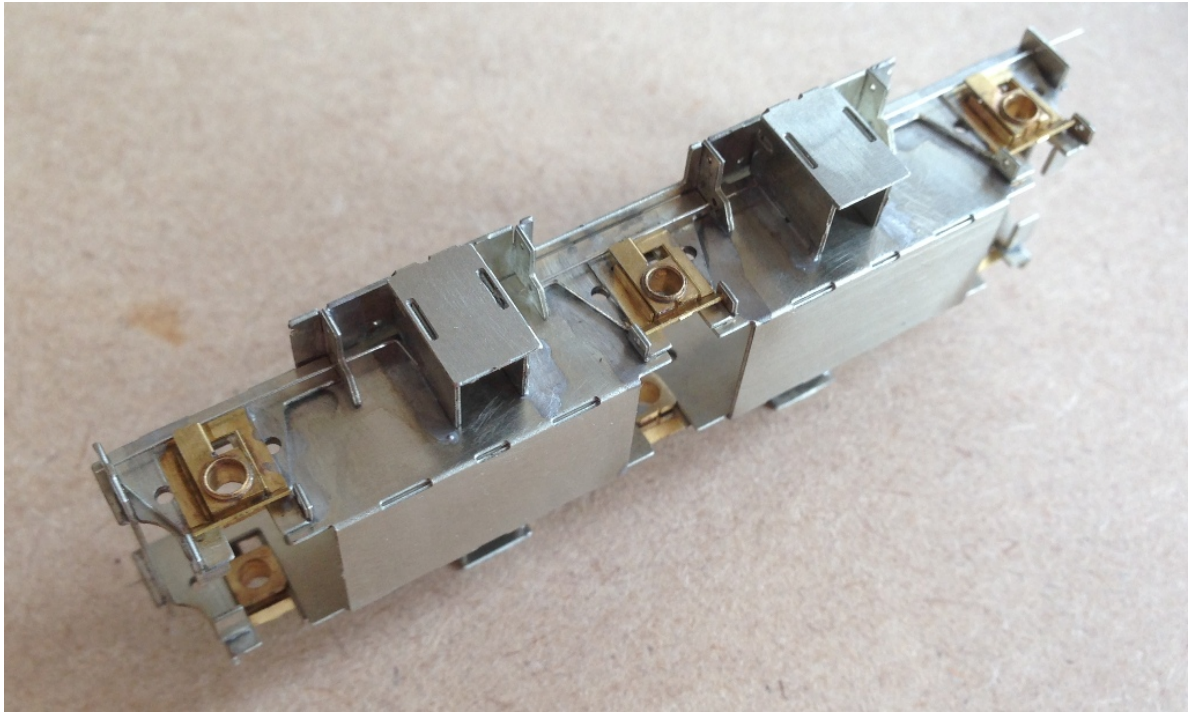
The frame spacers (3) can also be fitted at the ends of the bogie. These simply slot in place. Solder to the mainframes.



Fold up the bolster guides (4) as below. Note that they are handed and there is a correct way for them to go on the bogie. The large tabs that pass through slots in the mainframes are arranged so that you can only fit them one way though. Once the box is formed solder together.



Locate the bolster guides into place on the sides of the mainframes using the tabs and slots provided and solder in place. See photo below.

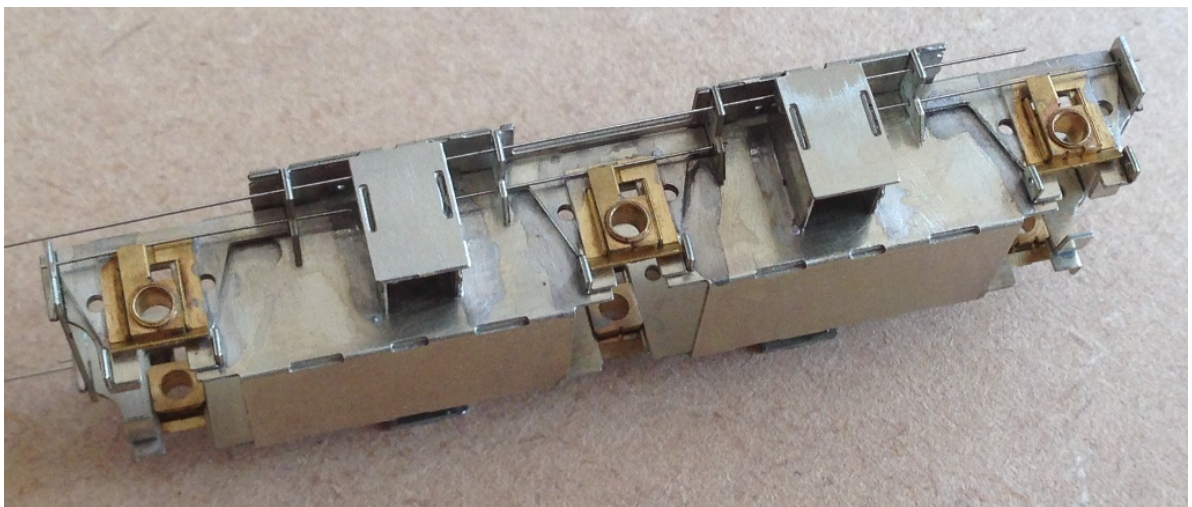


Fitting springs wires

For the primary suspension take a piece of the spring wire and form a 90° bend 1-2mm from the end. Cut the wire to 18.5mm overall length for the outer springs and 17.5mm for the centre springs. To fit feed the end with the bend in through in the inside fulcrum point on the mainframe (it doesn't matter for the centre axle). Gently bend the wire to get the other end through the second fulcrum point.

For the secondary suspension wire you will need similar springs approximately 1.5mm x 17mm long. There are holes etched into the frame strengthening plates (2) into which the short end of the L shaped spring can be located.

An alternative for fixing the springs in place is to use the sleeve of some very small electrical wire, glued into place at one end.

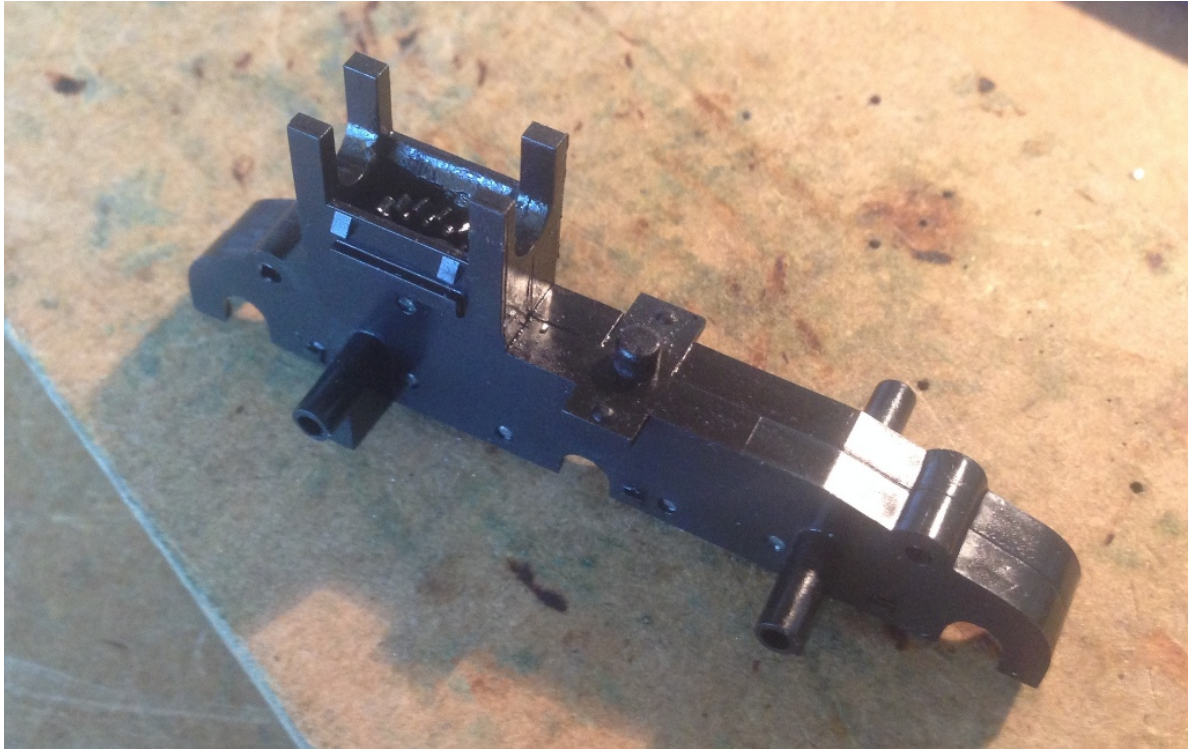


Disassembling the locomotive

The first thing to note is that these locos are not designed to come to pieces!

Remove the body by undoing the screws as per the maintenance diagram supplied with the loco. Unsolder the pickups and unclip the keeper above the worm on each bogie. The bogie should then simply drop out.

Remove the sideframes. These are specifically the parts referred to earlier that are not designed to come apart so you may have to be forceful. Remove the keeper plates at the bottom of the bogies and then the wheels. Remove the locating points for the bogie sideframes from the drivetrains and also the little 'ears' either side of the pivot point.



Wheel Assembly

The next step is to assemble the wheels. You will need to remove the final drive gear from the RTR axles. Note that these gears **must** go back in the order that they came in. A gear puller would be nice to do the job but I find they can be removed with just the aid of a pair of pliers and applying pressure to the side of the gears around the axle. The gear will need to be drilled through and cut so that it fits between the bearings in the mainframes. They can then be fitted to the new axle. I find a short length 2mm inside diameter tube useful for pushing the gear into the centre. You can use Loctite 603 to help retain the gear making sure it is central on the axle. Everything else necessary can then be fitted to the axle. Bearings (**making sure they are the orientated correctly**), spacing washers (5) if required and finally wheels. There shouldn't be any side play on the front and rear axles so I have included axle washers to take up any slack.



Fit the wheels and axles to the bogie.

Pickups

You will need to contrive a method of pick up for the electrical feed. The unmodified loco uses a split axle arrangement acting on pin point axles. I generally use little coiled wire springs. I'd suggest if there is room to mount a piece of thin copper clad onto the bottom of the mainframes and then mount little coiled wire springs to this. It should be easy to make sure they miss everything metal in this position.

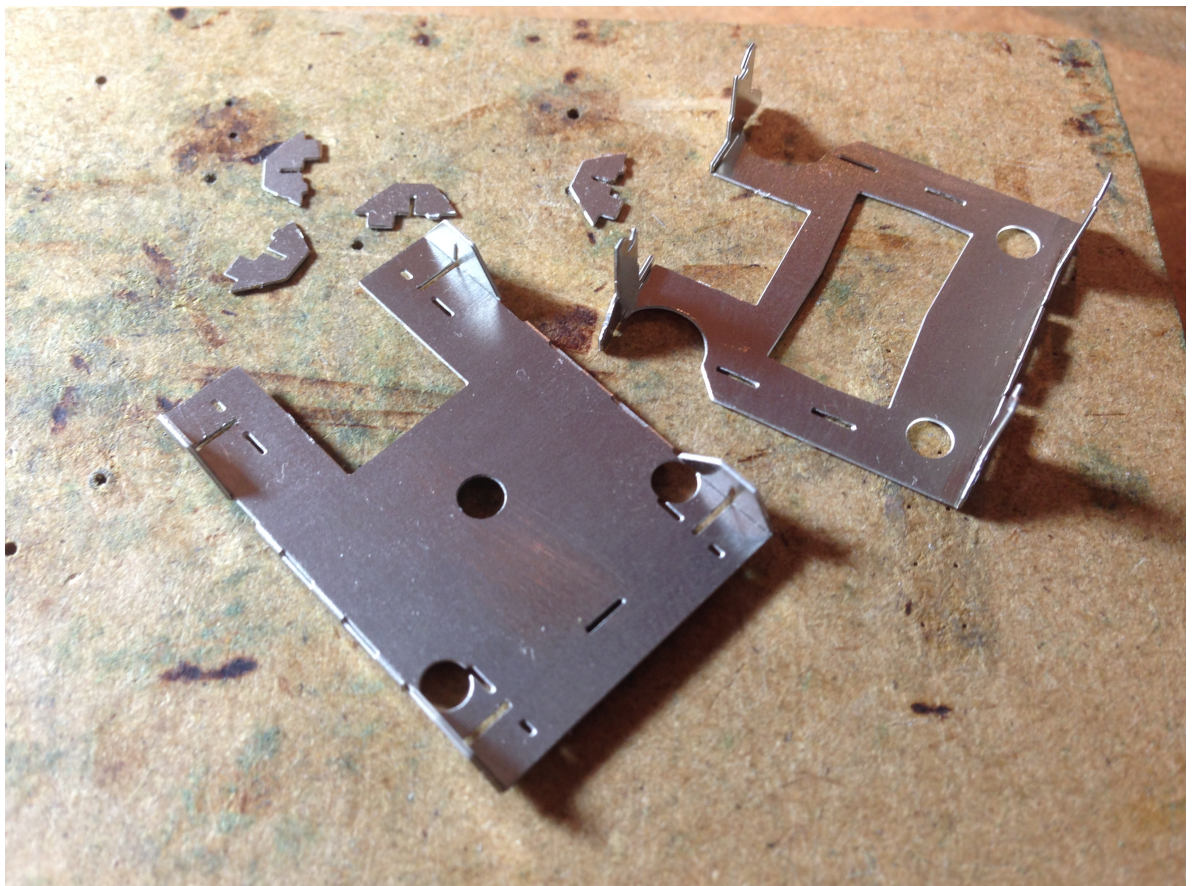
I make pickups from 33SWG phosphor bronze wire. These pickups then act on the flange of the wheels. The springs are made by winding the wire around the shank of a 1mm drill bit. 3 or 4 turns in the spring will be fine. You can then reuse the RTR wire to take the power feed to the motor.



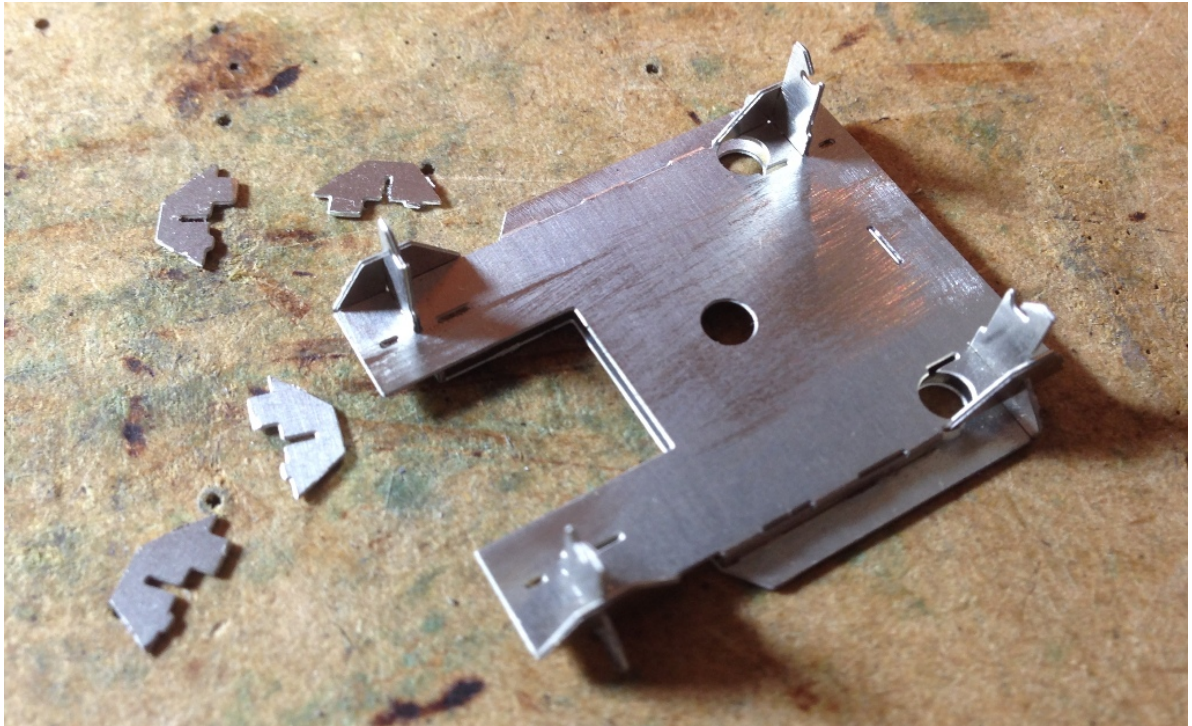
Bolster

The next job is to assemble the bolsters for each bogie.

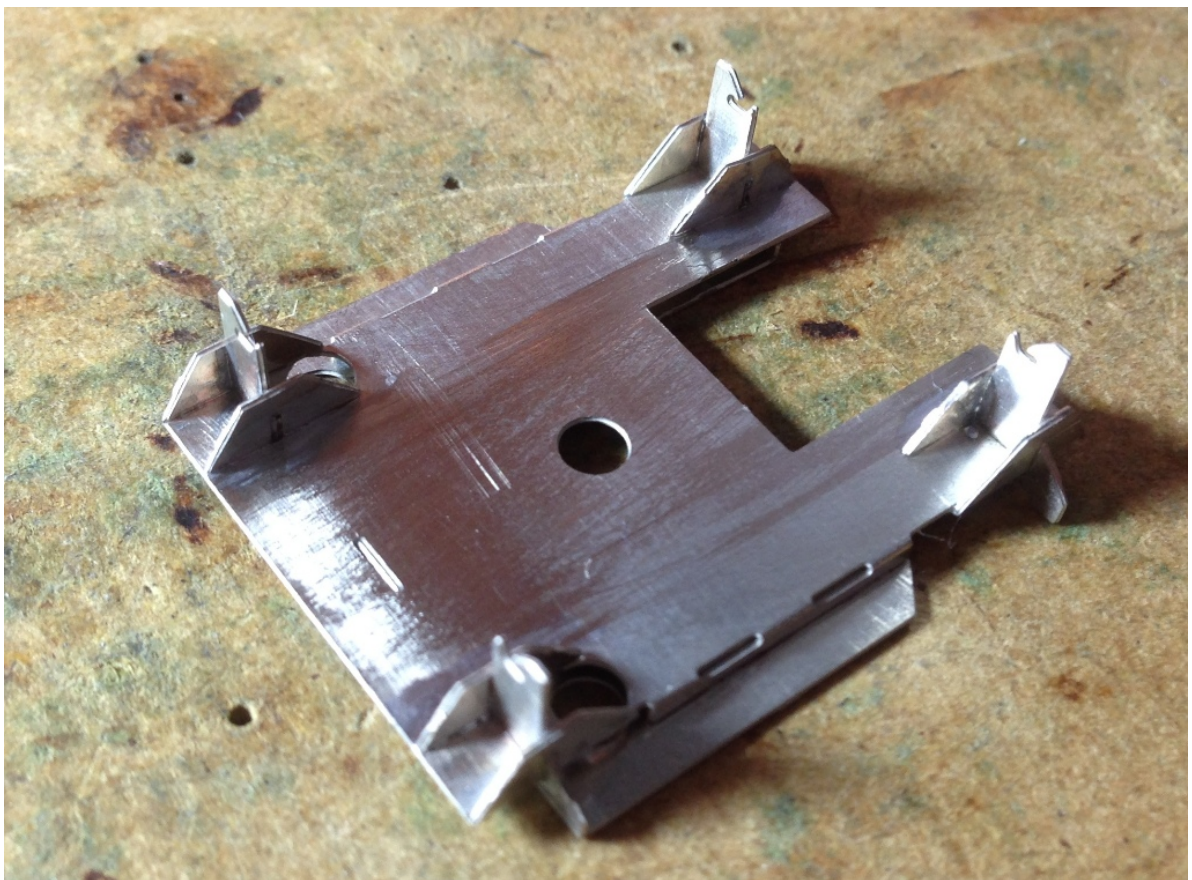
Fold out the spring clips and end tab on the bolster (6) long with the four spring clip supports and tabs on the bolster spacer (7).



Fit the two parts together as below. The bolster fits through slots in the bolster spacer. Make sure the tabs properly locate into the slots and solder together.

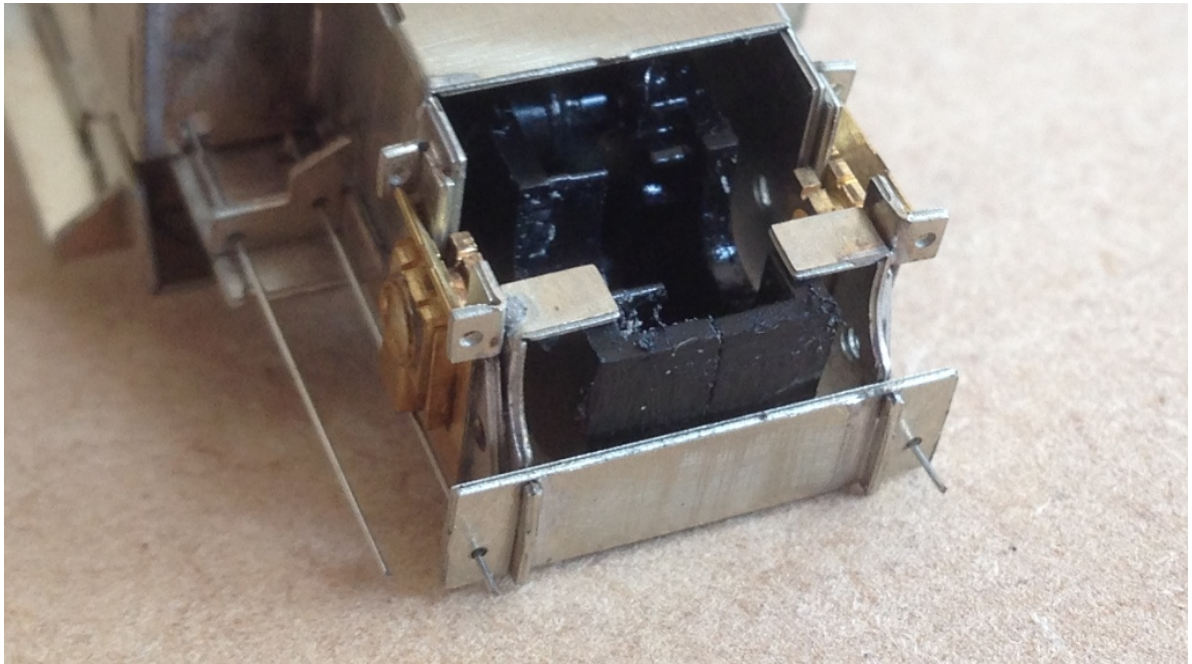


Fit the four bolster strengthening plates (8) using the slots and tabs provided. Solder in place.



Bogie assembly

Fold out the four drivetrain limiting tabs on the ends of the bogie. These should be at right angles of the mainframes. Fit the drivetrain into the bogie.



Fit the bolster to the bogie. The spring clips pass through the slots in the top of the bolster guides. Make sure that the springs are properly clipped onto the bolster (if they are you shouldn't be able to get the drivetrain out without moving the secondary suspension springs outwards). If they aren't try moving the secondary suspension wire outwards a little with a small screwdriver.

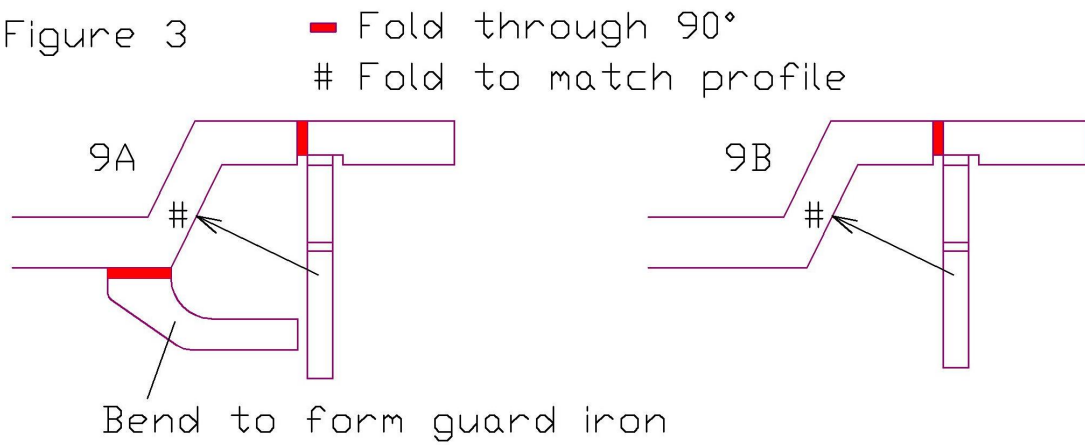
The bogies can now be test fitted to the chassis. They use the original pivot point and are retained in place using the keeper over the worm on the drivetrain. Fit the bogies without the worm and U/Js for the moment to check the running of the bogies. If there are any tight spots now is a good time to track them down and sort them out. Hopefully this won't be necessary. Once you are happy the sideframes can be fitted.

Sideframes

These can now be fitted to the bogies. Glue them in place against the bolster guides. Note that there are locating holes that make use of the spigots on the sideframes. These were absent from the test etches so don't appear in any of the photos.

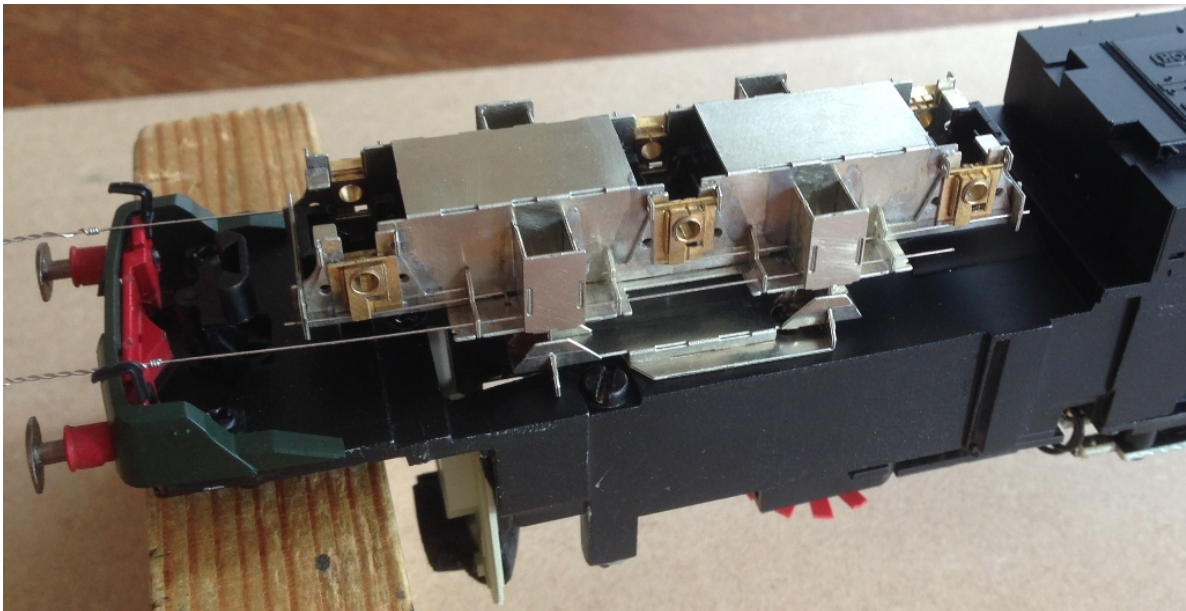
Once the sideframes are in place the cosmetic frame ends (9A - outer end and 9B - inner end) can be folded up and fitted. For folding details see Figure 3 below. Glue in place against the sideframes making sure the sides are up against the main bogie.

Figure 3



Final assembly

The bogies should now be complete. They can be painted or blackened before refitting the bogies with the worm, U/Js and worm keeper plate.

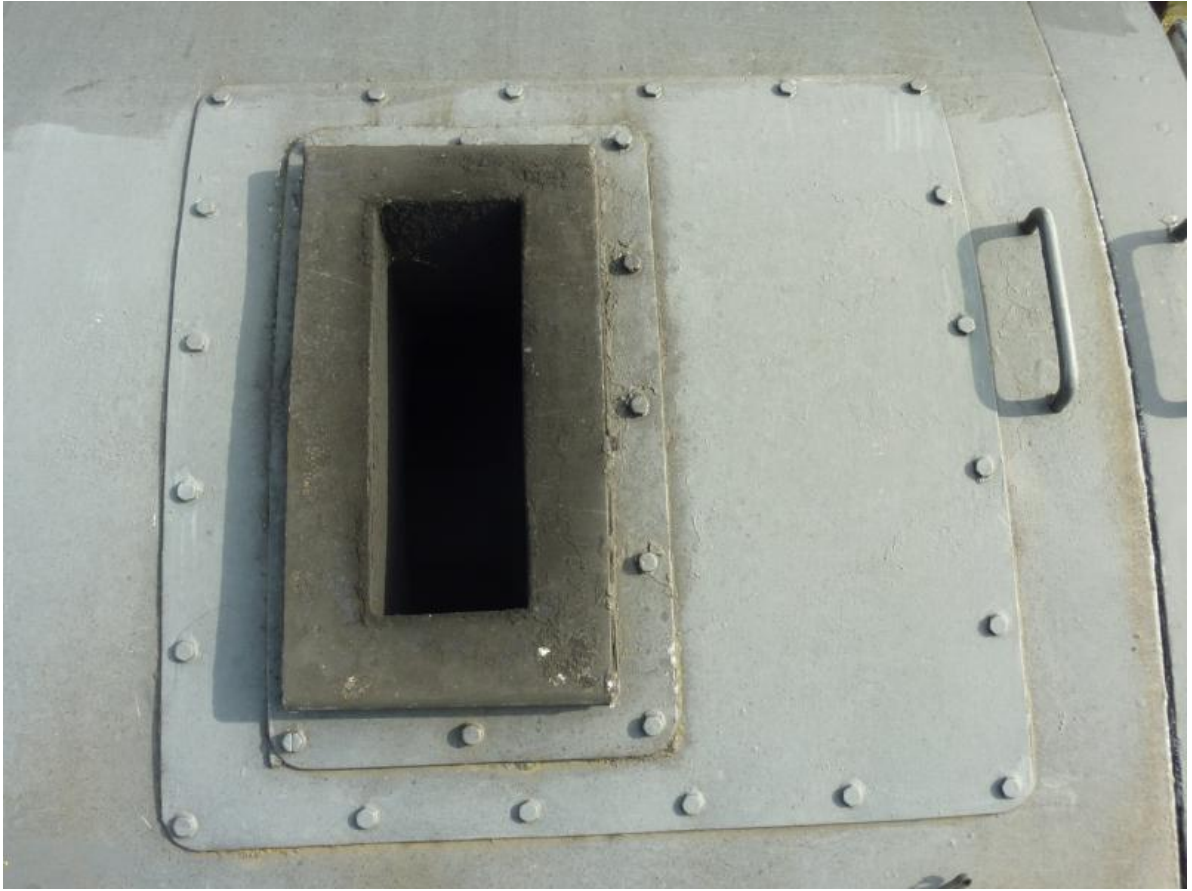


Once the bogies are in place the power feed wires can be connected up. You can then stick the loco on the tracks and watch as it glides along!

Note: When assembling one of our two test builds we had problems with torque reaction lifting the bogies. We strongly suspect that this was down to the drive gears not going back in the correct order. The other test build, where care had been taken with the ordering of the gears was fine as an all wheel drive model. If you have problems with the bogies lifting you may have to remove the idler gear just to the rear of the centre axle and turn the bogie into a B-1 arrangement. This should have little impact practically on haulage as there is so much adhesive weight with modern diesel locomotives anyway.

EE Exhaust Port

This part can be fitted to the roof for those who wish to add this particular exhaust arrangement. The smaller part simply fits over the larger one. I'd suggest rolling to the correct profile before soldering together.



Justin Newitt 2018