

Bolted wagon frame build instructions

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Please use these instructions in conjunction with the shopping list provided at the end.

We supply this kit in good faith as one enthusiast to another, you therefore build it and use it at your own risk.

Most of the laser cut mild steel parts are supplied pickled and oiled, you will find it easier to clean and degrease them before bolting up the assemblies. To aid paint adhesion clean the dark coating off the cut edges and lightly sanding or scouring the surfaces before fabrication, it is a lot easier than doing it afterwards. If you are going to use acid etch primer the scouring or sanding is not really required.

As development of any design takes place occasionally, some of the parts supplied to you might not look exactly as they do in the photographs in the instructions.

Use thin 'form B' washers under every screw head, it prevents the screw marking the paint and gives the screws the correct clearances in the slots.

Remove the nibs left by the laser cutting process from all parts, especially from the inside any holes where bearings will be pressed in.

Tools required

I am assuming that you already have the basics, drill, spanners, screwdrivers etc

An angle grinder with a flap disc is handy for removing sharp edges.

An arc or MIG welder or a mate who can do a few welding jobs for you.

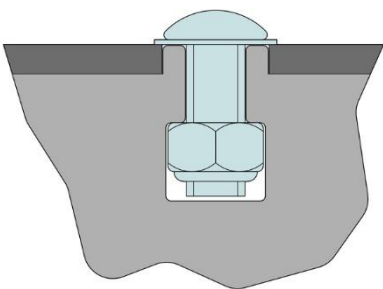
Pop-rivet gun.

Wire strippers and crimping tool.

A battery drill or screwdriver with adapters for allen keys and 10mm and 13mm sockets will speed things up a lot.

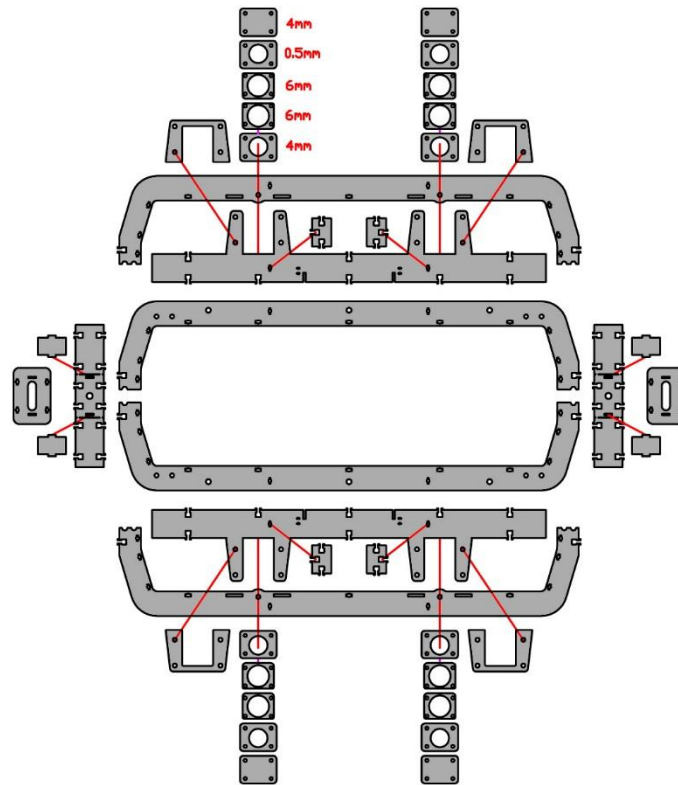
Need I remind you, SAFETY GEAR, buy it and wear it, especially gauntlets and goggles when using the angle grinder.

The basic construction method



The frame is bolted together as shown, unless otherwise stated use M6 x 16 button head screws with thin (form B) washers and nyloc nuts. The tab is inserted in the slot, the nyloc nut slid into place and the screw with the washer fitted is tightened finger tight at first, then once all the screws for the current operation are in place they are tightened with a battery screwdriver or electric drill set on it's highest torque setting. If you are using a battery screwdriver you may need to do an extra tighten by hand just to make sure that the screws are fully home, they don't need to be super tight.

First the frame parts.



First lay out all the frame parts provided with the kit. This shows the parts of the basic unbraked frame. The build of the braked frame will be covered later in the instructions.

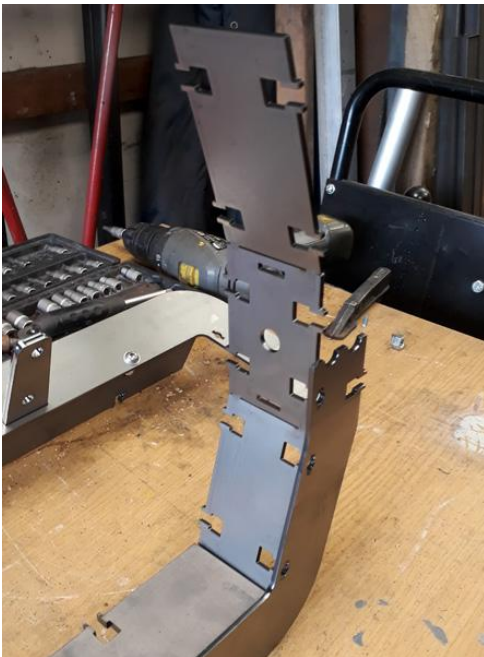


Assemble the gussets on to the two side frames with M6 x 16 button head screws, thin washers and nyloc nuts. The gussets will hold the upper and lower plates accurately to form a strong 'channel' frame.



frame.

Slot the bottom plates into place and fix to the frames and gussets with screws, thin washers and nyloc nuts.



Fold the ends by hand so that they fit in the slots and fix to the frame.



Join the two halves together.

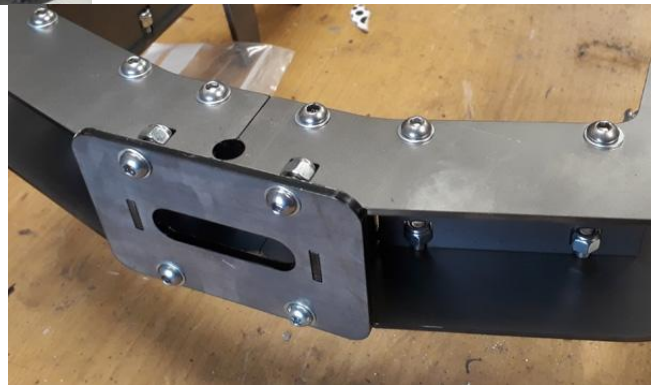


Add the two top plates and fix with screws, thin washers and nyloc nuts.



Add two coupling pocket sides. These are designed to be a tight fit, as you will probably want to remove the coupling front to paint the frame, and you will want them to stay in place.

Add the coupling fronts. This completes the basic frame.



Axleboxes

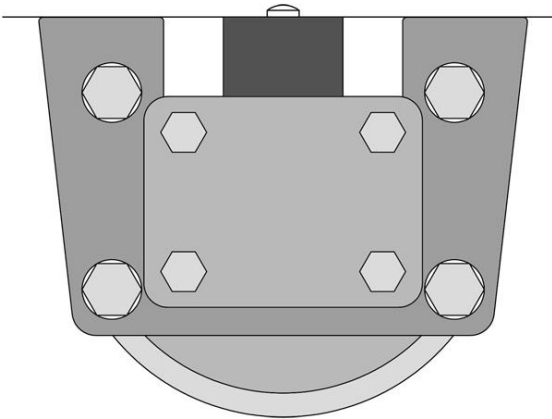
Take two 6mm thick axlebox pieces and clean any projections inside the hole with a half round file. Take a look at the bearing housings and you will see that the surface next to the cut is slightly discoloured on one side and clean on the other. The two discoloured faces face inward, fit the bearings in from the discoloured side first as the hole is fractionally larger. Press a bearing into one piece using the vice as seen in the first photo below, doing your best to keep it square, turning it frequently and doing it a bit at a time. You will find it suddenly enters the hole and presses in smoothly. Then press a second piece on to the bearing, closing up the gap and finally setting them on top of the vice jaw and tapping them with a hammer to get them perfectly aligned.



Assemble the axleboxes. First comes the plain outer cover in 4mm plate, then the 0.9mm thick spacer, the assembled parts with the bearing fitted, then the inner 4mm cover with the hole in it, aligning it to match the bearing. Use M6 x 25 hex head screws with no washers and plain nuts on the inside. The tops of all four pieces should be level, forming the top surface on which the rubber spring sits. Now try them for size in the slot in the horns. Touch with the file or grinder if required.



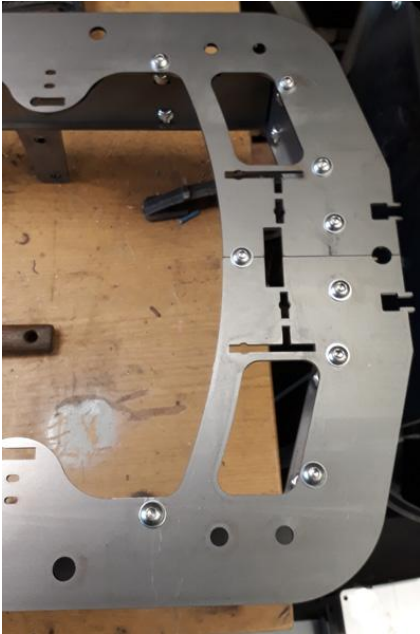
The threads on the rubber mounts need to be cut down to 3mm long or less before assembly, I place 2 washers over them as a guide and use a cutting disc on the angle grinder, but you could use a hacksaw. Check that when placed in position in the holes in the frame that the mounts sit on the frame, not on the tip of the thread. This ensures that all four axleboxes sit at the same height.



Push the axleboxes onto the axle ends, using a good dollop of decent grease as the ends of the axles will bear against the insides of the covers on the bends. Omit the grease at your peril, I have seen axle ends get so hot that they have welded themselves to the inside of the cover. That concludes the build of the basic frame.

Braked frame.

Follow the instructions above, with the following variations.

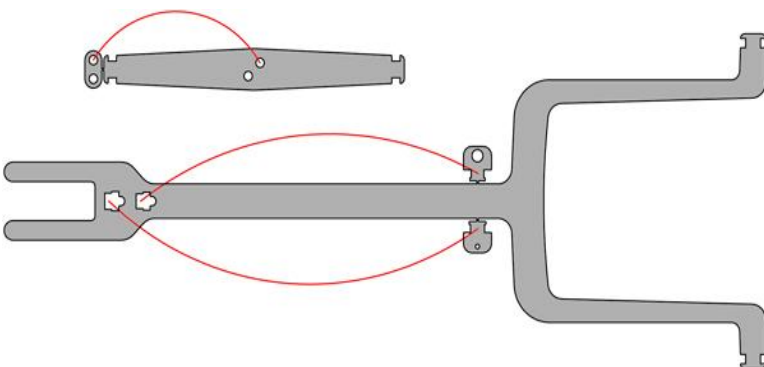


One end of the braked top plate is set up to receive the brake quadrant, assemble the two top plates as shown, noting the extra screw on the centreline holding the two halves in alignment.



The PNP glass filled nylon brake shoes are drilled and assembled to the brake hangers as shown. The shoes are handed, the curved face is tapered and the narrower side fits towards the flange of the wheel, the top side in this photo. Therefore you have to make two right hand and two left hand assemblies.

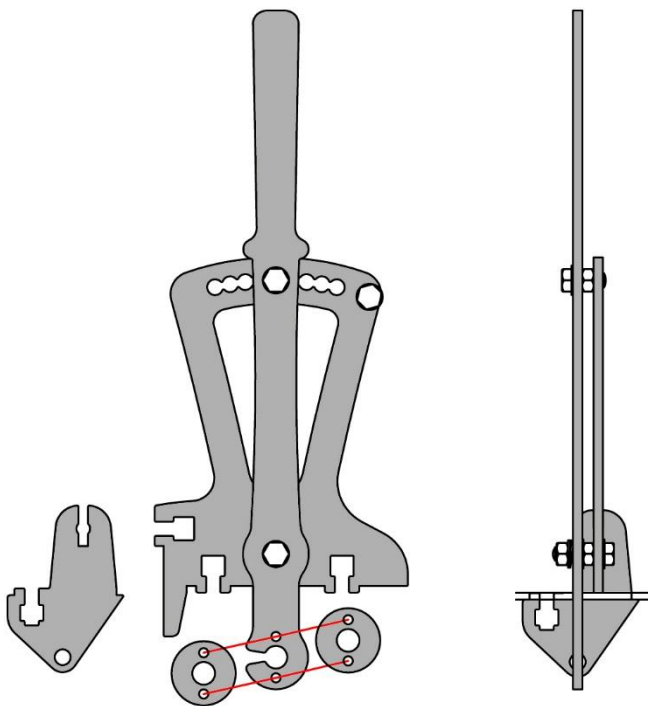
The brake hangers are assembled in the slots in the top plate as shown, there is a washer between the underside of the plate and the nyloc nut, this keeps the brake hanger from falling out.



The tabs need to be twisted off their respective equalising bars and the nibs cleaned up with a file, then they are inserted into the holes in the arms (if they won't go in, you have them in the wrong hole!). An M6 x 16 button head screw and nyloc nut traps each in place. The equalising beams drop into the holes in the ends of the brake hangers, the photos will show you the correct way round. The 'prongs' will need to be pushed down to twist the other beam into place. Seen from underneath.



Handbrake lever.



The handbrake can be arranged to pull from either side, arrange it so that you pull it towards you from the side you will most often stand when running the coach or wagon.

The handle part of the handbrake lever needs the edges rounding off to make it more comfortable to use.

Place the handbrake quadrant into the slots in the footplate from the top and add the two retaining screws and nuts. An extra M6 x 16 screw is placed in the hole at the top of the quadrant to act as a lever stop, pushed in from the opposite side in the diagram opposite. You can cut the excess threads off flush with the nut and smooth off. Another M6 x 16 screw and plain nut are added in the hole at the top of the handle, also placed from the side facing you, round the end of the thread off once the nut has been tightened.

Push the stiffening bracket into the slot in the footplate from below, slide in the nut and tighten the screw with washer in place, then add the final screw between the bracket and the quadrant. The handbrake lever fits inboard of the quadrant, with the open end of the lower lever pointing towards the bracket. An M6 x 25 screw and plain nut are placed in the quadrant from the far side and tightened, a washer and the lever slipped on followed by another washer, a spring washer and a nyloc nut. Experiment with the tightness of the nut so that the lever can easily be applied and released.



You may find that you need to shorten the end of the screw which engages with the quadrant, and round the tip off a bit so that it engages smoothly in the holes.



The heavy duty handbrake cable is trapped in the slot at the bottom of the lever by the two discs which are fixed with two M5 screws. It is clipped to the underside of the top plate with a cable tie in the holes provided, and curved round clear of the wheel to enter the holes in the 'T' shaped brake beam as shown. The cable outer has to be cut to length to suit, best done with a cutting disc in the angle grinder. You can try cutting it using an old pair of side cutters and cleaning up with an old file. The inner cable is then pushed through and clamped in the other bar as shown. You want a bit of play between the blocks and the wheels when the lever is in the off position, or the blocks will chatter, so set the system up tight with the handbrake lever one notch from fully off. Finally cable tie the brake cable to the brake beam as shown, and cut off any excess in the inner cable, again I prefer to cut with an angle grinder as it leaves a clean end.



Coupling pins

I cut some 10mm black mild steel rod to 100mm long, and welded a washer 75mm from one end. You could also drill through and insert a roll pin. With the ends tapered and rounded off they make cheap but serviceable pins. You could also use M10 x 100 screws.



Shopping list, search Ebay for most parts.

Bearings 20 x 42 x 12,	4 off	£8	
Axle; 20mm bright mild steel round bar x 279mm long,	2 off.	£15	
Wheels, 5" diameter narrow gauge profile bored to suit 20mm bar, CMD Engineering. (CMD can supply wheels already welded to the axles).	4 off	£80	
Springs - vibration isolators 30 dia x 20 thick with male M8 thread one side. Search for 'vibration mounts'. (These come from China, delivery times of a few weeks are not uncommon)	4 off	£8.50/5	
PNP brake blocks, 7 1/4" narrow gauge style.	4 off	£18	
Motorcycle heavy duty universal cable for brakes	1 off	£13	

Fixings and fastenings

M5 x 16 button head screws	2 off
M5 washers	4 off
M5 nyloc nuts	2 off
M6 x 16 button head screws,	62 off
M6 x 25 hex head screws,	21 off
M6 thin 'form B' washers,	100 off
M6 spring washer	1 off
M6 nyloc nuts,	66 off
M6 plain nuts	20 off
M8 x 20 hex head screws,	16 off
M8 washers	32 off
M8 nyloc nuts,	16 off
M10 x 100 screws, coupling pins	2 off
M10 nyloc nut	4 off
cable tie for brake cable	2 off

Appendix

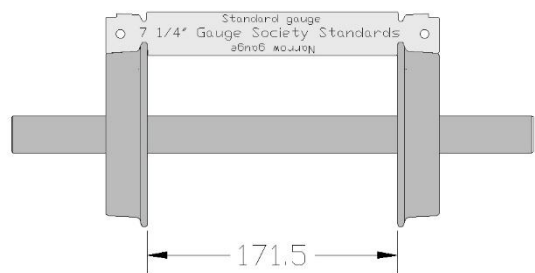
Welding the wheels to the axles.

Wheel and axle sets are available ready assembled from CMD

The axle ends need to be an easy fit into the 20mm axle bearings, if necessary spin them in the lathe or grip in the vice and use emery cloth to slightly reduce the size. (First put a cloth over the lathe bed to catch the dust created, as it makes good grinding paste and shouldn't be allowed to settle on the oiled surfaces).

If you are buying your wheels from CMD Engineering you may wish to ask Chris Dixon if they can be supplied already fitted to the axle for your convenience.

The use of 20mm bright mild round bar reduces the costs compared to buying specially machined axles. With the axle cut to length, 279mm, the centre is found and marked. The position of one wheel is marked at 171.5mm (the correct back-to-back dimension for 7 1/4" gauge narrow gauge profile wheels) divided by two, equals 85.75mm from the centre. (Just be as accurate as you can, don't worry too much about it as using the profile gauge will ensure that the correct back to back distance is achieved).



With the welder well wound up tack weld the first wheel to the axle, then use the profile gauge to tack the second wheel in place. Check that equal amounts of axle project at each end. Now complete the welding. I suggest doing it with the axle horizontal so that any undercutting due to the weld pool slumping happens on the wheel rather than the axle, where it could form a weak point that could lead to failure. With the correct positioning of the welder earth clamp the wheels can be slowly rotated as they are welded, allowing the weld to be done in three or four parts.



As a personal preference I like to see the axle and wheels painted rather than left to go rusty, but leave the end portion that will go into the bearing clear of paint.