

IMP build instructions,
Copyright CMD and Colin Edmondson
February 2026.



Disclaimer

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 build it and therefore use it at your own risk. As there is a 'dead-mans pedal' fitted, the Imp will not move if the driver is not aboard with their foot on the switch, making it more suitable for use by children.

NOTES

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.

The laser cutting sometimes leaves a small amount of oxide on the lower edge of the cut, particularly on thicker steel. I use the back of a hacksaw blade to scrape it off. You only need to remove anything that is loose.

Lightly sanding or scouring the surfaces before bolting together 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 screws marking the paint and gives the screws the correct clearances in the slots.

Remove the nibs left by the laser cutting process, particularly from the inside of 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 to fit the wheels to the axles and sprockets to the layshaft. These jobs can be done for you by CMD as optional extras.

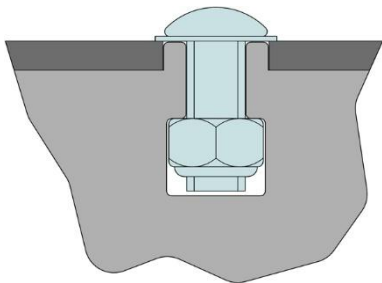
Pop-rivet gun.

Wire strippers and a decent quality 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.

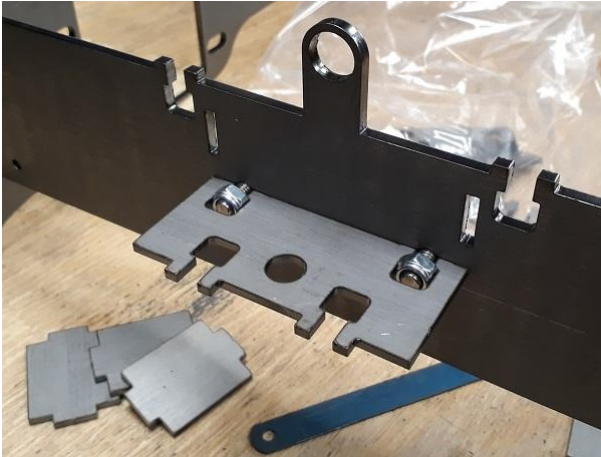
The basic construction method



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 cheaper 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.

The frame

Fit the buffer beams to the frames, note that the sets of four holes for the layshaft are opposite each other.



Fit the bottom halves of the couplings to the buffer beams.



With the layshaft holes in the frames to the left, fit the footplate as shown. This brings the control box and brake lever to your right hand. If you want the controls to be left handed turn the footplate over.



Fit the battery box brackets from the underside of the footplate.

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



Add the coupling fronts and fix with M6 x 16 screws and nyloc nuts.



Derailing bars



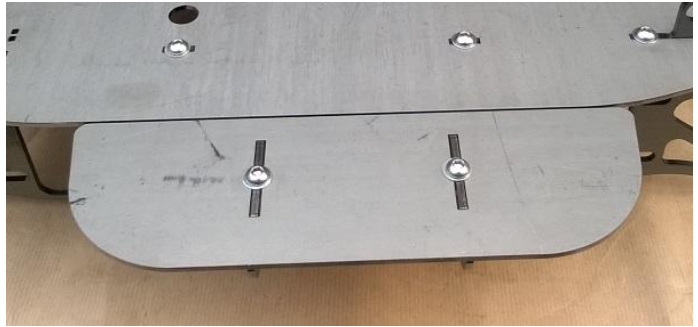
Cut your derailing bars at least 356mm long from the 20mm diameter by 2mm wall steel tube. Drill two 5mm holes in one side only of each derailing bar at 325mm centres, taking care to keep them in line. This is best done by clamping the tube in the vice and drawing the flat edge of a ruler, kept level, along the top of the tube to mark a line.



Slide the derailing bars into the holes in the frames and fit the tabs to hold them in place. The tangs on the tabs fit into the holes that you have just drilled and are screwed to the frames.



Footrest



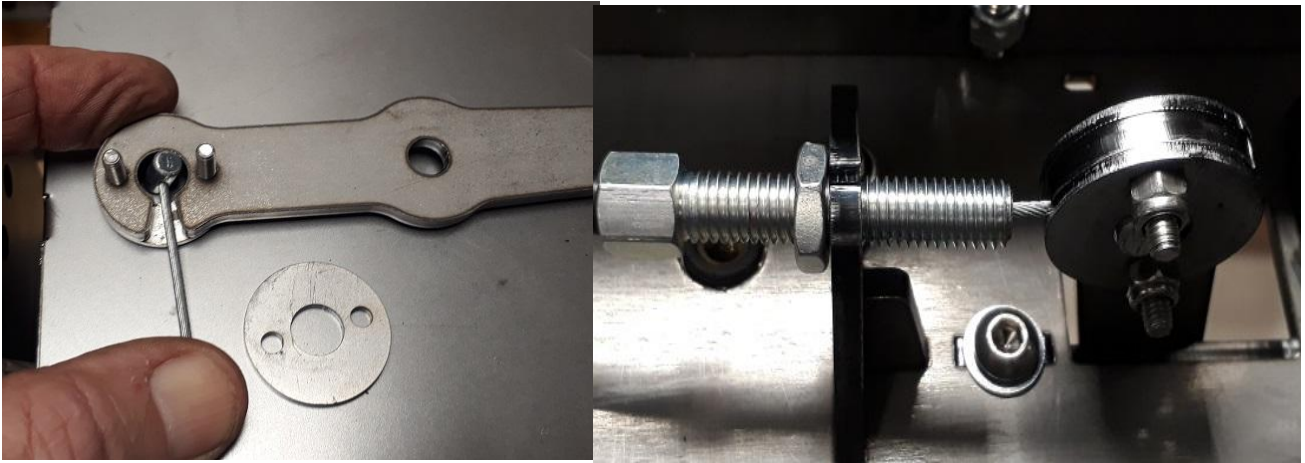
Add the support brackets to the foot rest. The assembly slides into the slots in the frames and locks into place.

Brake lever

File a chamfer on one side of the pawl as shown. Cut a 100mm length of 20mm diameter, 2mm wall tube, clean up the ends and drive it over the projecting stub of the 6mm thick lever centre and cap it with a plastic cap. If the tube is a loose fit on the lever then first squeeze the tube slightly in the vice and try it again.



Assemble the parts of the lever top as shown. The tapered side of the pawl is towards the camera in these photos. Tighten the screws until the parts are just nipped up, make sure that the latch and latch lever can operate freely, then finally tighten the screws. Add the spring.



The heavy duty handbrake cable is trapped into the slot at the bottom of the lever by the two discs which are fixed either side of the lever with two M4 screws.



Fit the stiffening bracket into the slot in the footplate from below, place the handbrake quadrant in from the top and add the four fixing screws. Fit the lever with an M8 x 30 screw as a pivot, with washers both sides and between the lever and the quadrant, and a nyloc nut. The tightness of the nut controls the stiffness of the brake lever, so don't over tighten it. Leave the oiling of the moving parts until after painting. The outer cable may need it's plastic coating removing for 6mm or so to allow it to enter the adjuster, which is fitted as shown. After painting I protect the tubular handle with a length of heatshrink tubing.



The bonnets

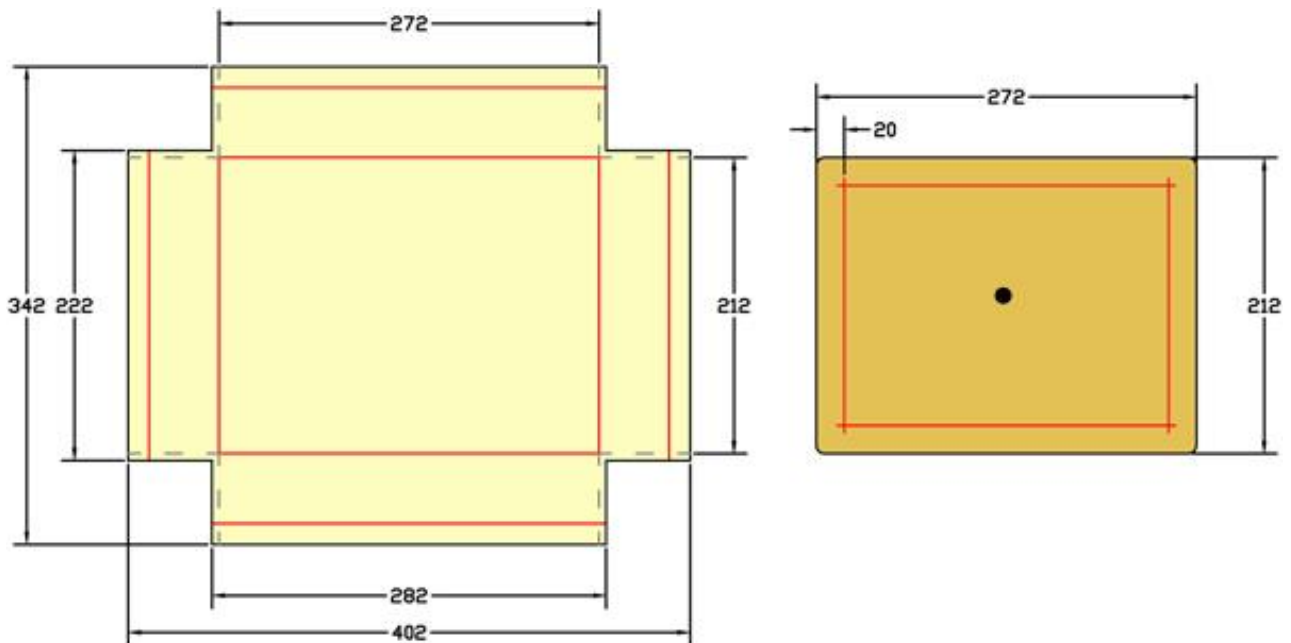


Clamp each bonnet in turn in a workmate or between two lengths of timber with just the top flange protruding. Using a block of wood the same length as the flange grip the block and wood together and fold the flange over 45 degrees. Use the same method to fold both sides back 90 degrees.



The bonnets mount on a bracket each side and one in the middle of each end. Push a rubber well nut into each 13mm hole, hold the bonnet in place and fit with a 16mm button headed screw and washer in each nut. Tighten enough to swell the rubber to grip the hole. Two holes are provided to pop-rivet the IMP badges in place as shown.

Seat cushion



The base is made from a piece of 9mm ply, cut to the size shown on the above right. Two faint lines are drawn to mark the centres, and a line 20mm in from each edge. A 10mm hole is drilled in the middle to allow the air to escape when you sit down. The foam we use is a layer of 25mm pink reconstituted, which is fairly hard, topped with a 25mm layer of blue, which is a lot softer. This allows the cushion to mould to fit you without you ending up sitting on the plywood! The foam needs to be about 5mm larger all round than the plywood.



Use spray adhesive to fix the foam to the wood, with an even overhang all round. The material is marked up as shown on the left, a rectangle the same size as the plywood, an extra 50mm all round followed by 20mm all round, also make a mark in the middle of each long edge. The corners are marked to plywood size plus 5mm for the hem, and the rest cut out. Think of the red lines as fold lines, the grey dotted lines are where you will sew up the corners. Fold the material in the corner inside out so that the two right sides are together and pin through the dotted lines. Sew up the four corners as shown right, curving the stitching inwards towards the top so that you get a nicely rounded corner.

Stretch the material over the foam and plywood, pushing the foam into the corners and easing it so there are no lumpy bits. On one long edge line up the centre of the material with the centre of the plywood and staple it with the edge of the material on the marked line. Easing the foam again staple the middle of the opposite side on the line. Now do the centres of the other two sides, again pulling the material to the line. Stretching and easing the material so that it stays on the line, add staples about 20mm either side of the first one on each side, then another, working outwards until you reach the corners. You may have to cut off a little of the excess material to get a neat corner, tuck the folds as neatly as possible with a blunt edge and tap any lumps down with a hammer. The cushion can be screwed to the top of the seat box with screws no longer than 10mm.

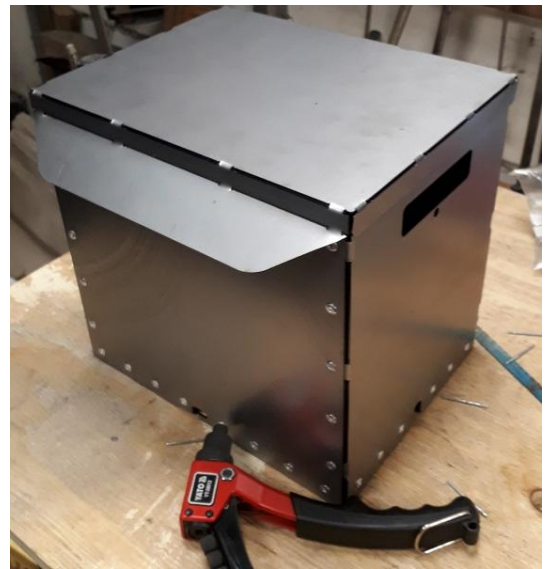
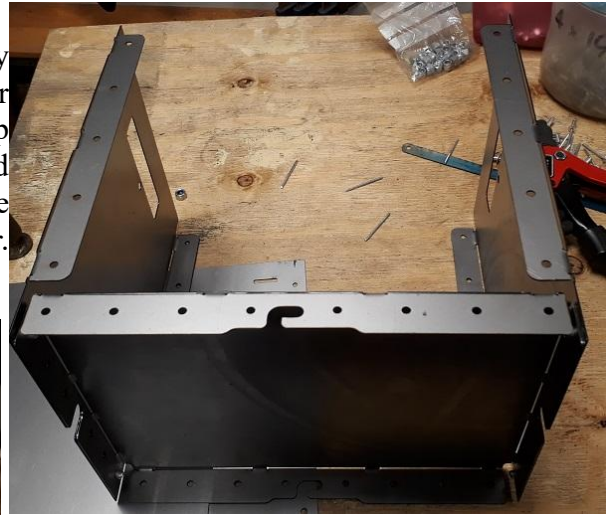
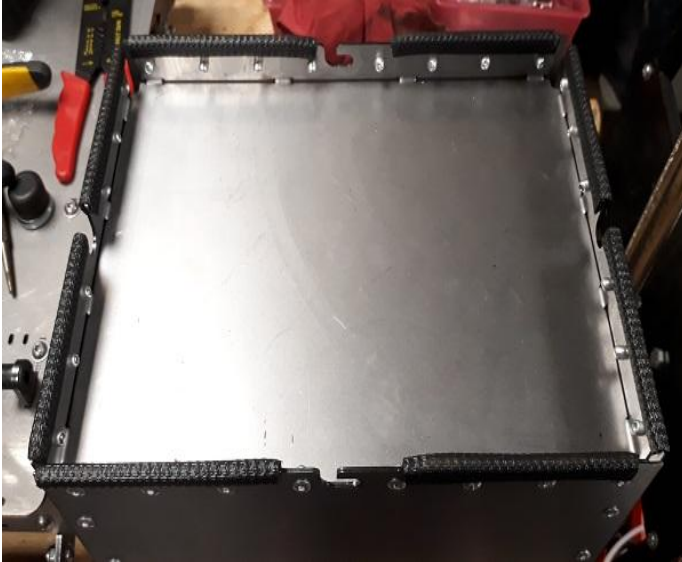
The battery box

This has been designed to take two 12 volt mobility scooter batteries to give a working voltage of 24v. Be very careful when working with batteries, there is a lot of potential energy stored in one and a short circuit can create a great deal of heat in a very short time. Always be aware of this when connecting up and especially when working with a spanner inside the box, make sure that there is no chance of it touching the box or a bare wire of the opposite polarity.



The parts are easily folded by hand with the by simply pressing the flanges against a flat table top or holding them in a combination of vice and pliers or mole grips. Just make sure that the flange is folded in one go and doesn't end up being twisted and stretched.

The two side panels have their edges folded to ninety degrees, the bottom has all four sides folded up or down, and the lid (right), has all the edges folded up or down with the two little lugs seen at the top folded facing inwards with pliers and the final 'rain flap' at the bottom folded out at 45 degrees to protect the breaker.



The flat sides are pop-rivetted to the base with 4mm x 6mm long aluminum pop-rivets with the 'L' shaped slots matched up. Edge trim is added to all sides of the base.

Axle sprockets.



When designing the IMP I choose to use taperlock sprockets on the axles and mount them outboard of the wheels so that they could be quickly removed and replaced with different ones depending on the speed limits of the track the loco is going to be used on. If you want to use the Imp as a slow hauler with a sensible top speed of around 5-6 mph choose 27 tooth sprockets, or 24 tooth for a compromise between pulling power and not being a rolling road block!

Axles and taperlock bushes need to be cleaned and grease and paint free, note that the bushes are often supplied oiled for rust resistance and will probably need to be cleaned. Put a spot of oil on the thread of the screws as you put them in. The sprocket is set with a 10mm gap between sprocket and wheel face, using the head of an M6 bolt as a guide. The socket screws are tightened up a bit at a time, first one side, then the other, then the first side again, until they are as tight as you can get them. Then tap the centre boss inward with a copper hammer and tighten them again, and again.

If you need to reposition or change the sprocket undo the set screws and fit one of them in the central hole instead, tighten it fully then tap the sprocket inwards with the hammer and it should release immediately.



Axleboxes and springs

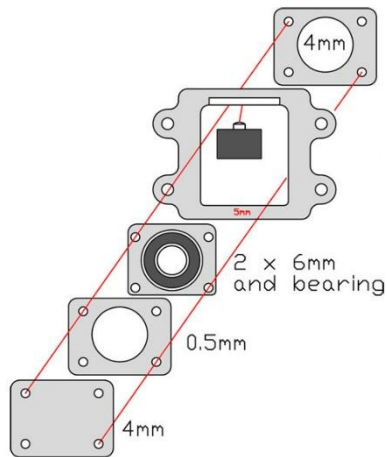
First clean the nibs left by the laser cutting process from the insides of all the axlebox and layshaft bearing mounts.



Take two 6mm thick axlebox pieces. 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 should find it suddenly enters the hole and presses in smoothly. If they seem at all reluctant to go in then use a half round file to ease the hole, if they are too tight it can compress the bearing leading to failure in service. 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.

The thread on the rubber mount needs to be cut down to 3mm long before assembly, I place 2 washers over it as a guide and use a cutting disc on the angle grinder, or mark it and use a hacksaw.





Now try the axleboxes for size in the slots in the horns. Clean up the sides with a file or angle grinder if required, then assemble as shown, using one 5mm thick and one 6mm thick horn guide for each guide. adding a plain axlebox cover one side and one with a hole on the other, using M6 x 30 hex screws. Make sure that you align the parts so that the hole in the inner is central with the bearing and the tops of all four pieces are level, as this is the surface that the rubber spring sits on.



Fit the axlebox covers in place and fix with M6 x 30 screws with washers on both sides. Slot the axles into the frame, with the sprockets at diagonally opposite corners.



Shaft collars are slid onto each end of the axle after fitting the sprockets and before adding the axleboxes..

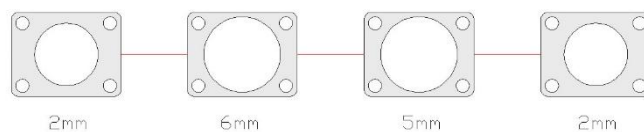


A good dollop of grease is put into the axle end and into the bearing, the axlebox is pushed onto the end of the axle and bolted to the frame with M8 x 35 screws and nyloc nuts, you will need to loosen again them later to adjust the chains. Note that the rear of the loco, with the handbrake lever, is at the bottom of the photo here.

With the axlebox screws tightened up the shaft collars are set as follows. Push the axle fully to one side, push the collar on that side against the bearing and gently nip it up. Then slide the axle fully to the other side, there will now be a gap between the shaft collar and the bearing. Release the screw and slide the collar across until the gap is about half what it was and tighten the grub screw. Now push the axle across to close that gap and fit the collar on the other side with a 0.5mm to 1mm gap between bearing and collar, shove the collar hard home then move it back by eye and nip it up gently. The collars ensure that the axle ends are kept clear of the outer axlebox covers and the clearance ensures that the axleboxes aren't pressed hard against the frames and can still slide freely up and down. Now check the alignment of your sprockets with the layshaft sprockets, and if necessary adjust the collar positions slightly until the chain lines up and the collars give the axle less than 1mm side to side movement. Once you are happy fully tighten the grub screws to lock the collars to the axle and repeat at the other end.

Layshaft

The layshaft is provided as a welded assembly by CMD.



The 15mm bearings are pressed into the layshaft bearing housings just as you did for the axleboxes earlier, using a 6mm thick and a 5mm thick piece each side to suit the 11mm thick bearing, with a 2mm thick piece on the inside for clearance and on the outside to keep the bearing locked in place.

You may have to use emery cloth to slightly reduce the size of the ends of the shaft to get it to fit easily into the bearings. The fit needs to be such that it is easy to slide the bearings on and off the ends. Wipe a smear of grease round each end of the shaft to aid assembly and future dismantling. Fix the bearings to the frame with M6 x 30 hex screws and nyloc nuts, aligned as seen in the photo at the bottom of the next page.

Motor and chain

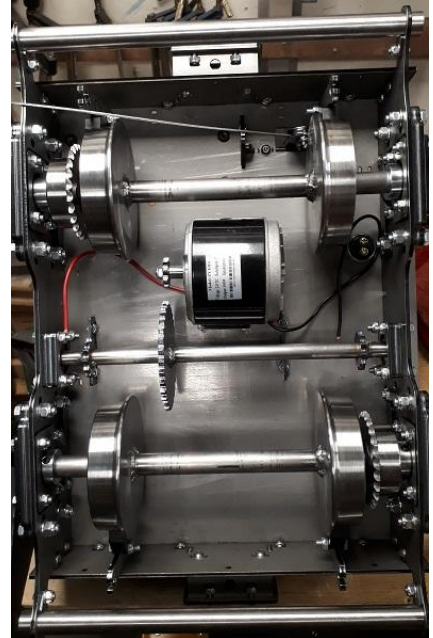
Note that the motor sprocket nut is a left hand thread, turn it clockwise to undo it. The motor sprocket supplied has to be replaced with a 9 tooth 06B (9.5mm pitch) one to suit British chain standards, a replacement is supplied with the kit. The edges of the sprocket need to be chamfered as shown to give a gentle lead in to the chain, just using a file is sufficient or stick it over a bolt in the vice and use a flap disc in the angle grinder, the sprocket will spin fast so don't let it escape. Alternatively fit the sprocket to the motor and spin it on a battery while you use a file to chamfer the sprocket and smooth the edges.





You may need ease the hole in the sprocket with a small file before you tap it on, you should only tap it gently to save damage to the motor bearings. Tap on a socket placed over the shaft to avoid accidentally damaging the threads. Nut lock adhesive on the thread is a good idea, use the lock washer and don't over tighten it as the metal is not of the best quality.

The motor simply bolts into place under the footplate, using four M6 x 16 screws and washers, lining the sprocket up with the one on the layshaft. The wires from the motor are led back under the motor foot and clipped out of the way along with the brake cable under the footplate with cable ties in the holes provided. The 'dead man's pedal' wiring can also be seen in this view.



I find that this is the easiest way to cut chain to length if you don't have a link extractor. Cut through the outer links with a cutting disc in the angle grinder, taking it a touch at a time so that you only cut through the outer link. Cut both sides and the chain will part leaving the pin free to be pushed out. Alternatively grind the protruding face of the pin flush with the link and drive it out with a pin punch.



When fitting a connecting link position the two ends of the chain on the sprocket and push the link into place, a lot less fiddly than trying to do it in the middle of a run. It is good practice to fit the link with the closed end of the spring link pointing in the usual direction of travel, so that if anything catches it then it won't spring off.

Chain tension adjustment

The motor slides to adjust the primary chain tension, as do the axles to adjust the secondary chains. Don't over tighten the chains, as it robs power and leads to accelerated wear in the chain and the motor bearings. The chains should be fitted with a tiny bit of slack, rotate the axles to make sure they don't tighten at any point.

Take care to keep the axles square, you can check that the position of the axleboxes is the same on both sides by comparing the position of the axleboxes in the holes in the frame, thus keeping the axles parallel and square to the frame.

Brake linkage



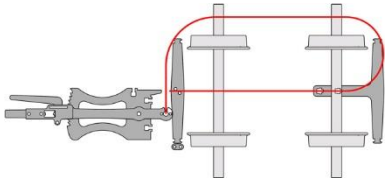
The PNP glass filled nylon brake shoes are drilled 6mm and assembled to the brake hangers as shown. The shoes are handed, the curved face is tapered and the narrower side with a curved edge fits towards the flange of the wheel, the top side in this photo. Therefore you have to make two right hand and two left hand assemblies. To make the job of drilling the holes easier PNP have produced a video on YouTube which shows just how to do it. Search for 'Video showing how to drill brake blocks for model and miniature railway locomotives & rolling stock.'

The brake hangers are assembled in the slots in the top plate as shown, a washer between the screw head and the footplate keeps the brake hanger in it's place whilst allowing complete freedom of movement. The sharp edge of the brake shoe is to the outside, with the curved edge against the wheel flange.



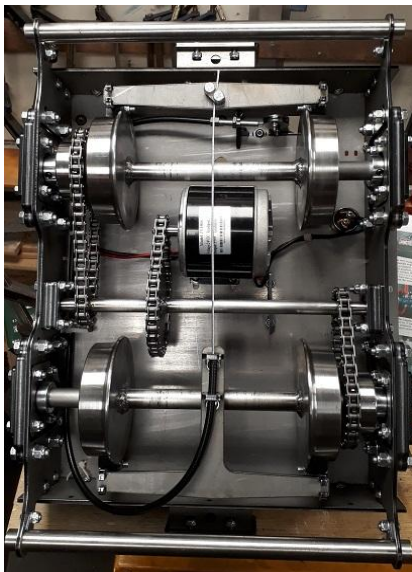
The taper on the brake shoes should match the taper on the wheel tread as seen here.

The tabs on the brake equalising beams need to be twisted off their respective bars and the nibs cleaned up with a file or grinder, then they are inserted into the holes in the arms (if they won't go in, you have at least one of them in the wrong hole!). An M6 x 16 screw, washer and nyloc nut holds each in place. The equalising beams drop into the holes in the ends of the brake hangers and rotate to lock them in place, the brackets end up underneath the brake beams.



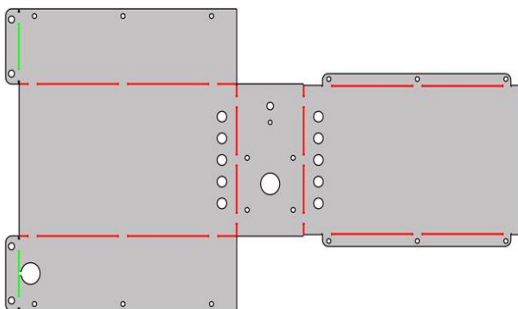
This diagram shows the cable routing.

The cable outer has to be cut to 785mm long, a job 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 or on a grindstone. The inner cable is then pushed through and clamped in the other bar as shown.



Pull the inner cable tight with the handbrake lever set on notch one, you only need to leave a tiny bit of play between the blocks and the wheels when the lever is in the off position, or the blocks will chatter and the 'T' shaped beam may sag low enough to catch on the track. Finally cut off any excess in the inner cable, again I prefer to cut with a cutting disc in an angle grinder as it leaves a clean end. Protect your fingers from the sharp ends with a wrap of PVC tape round the cut end. Holes for cable ties are provided in the footplate alongside the frame so that the brake cable can be held up tidily out of the way, making sure that it is clear of the wheels and chains.

Electrickery.



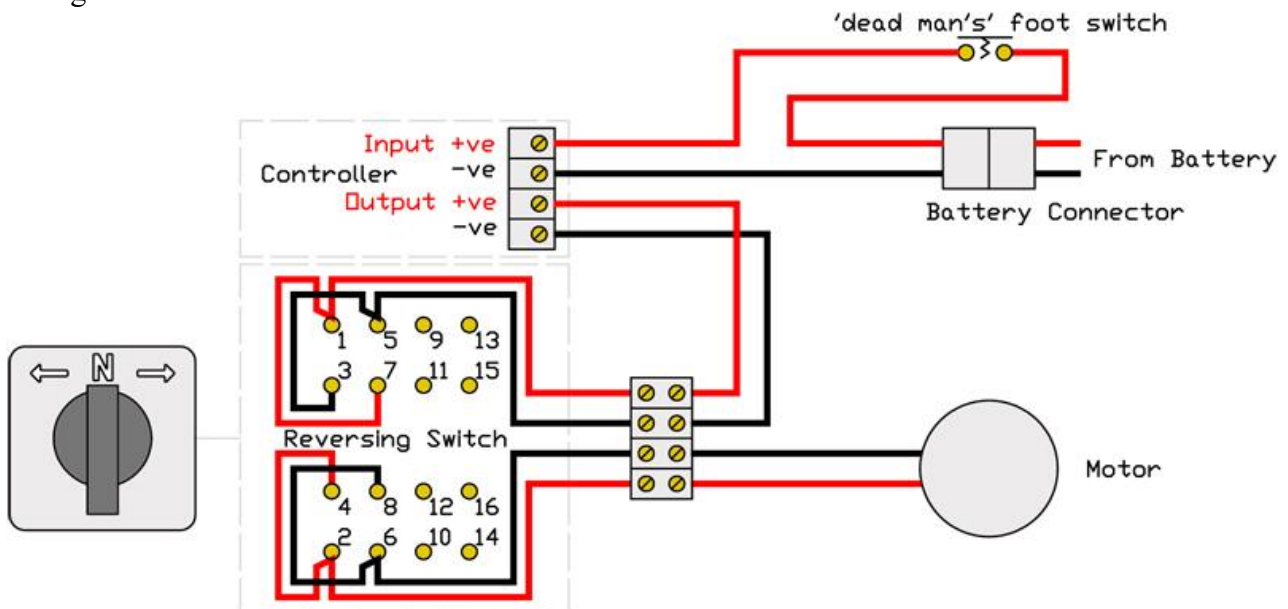
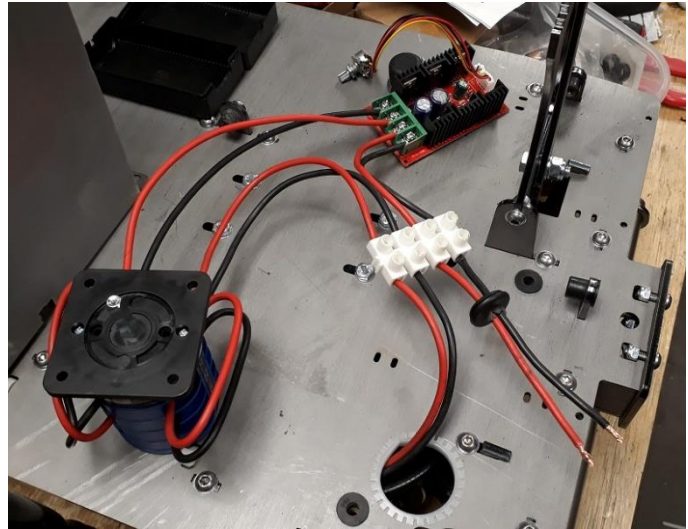
The control box provides a housing for the reversing switch and the controller. Fold all folds marked in red down 90 degrees by hand, green up 90 degrees, and assemble with 4mm pop-rivets. The long flanges should end up on the inside of the box. Use a file or a flap wheel in the angle grinder to dress the outside of the folds smooth if you so wish. The switch box mounts to the footplate with four M6

x 16 screws passing through the base into well nuts placed in the holes in the footplate.

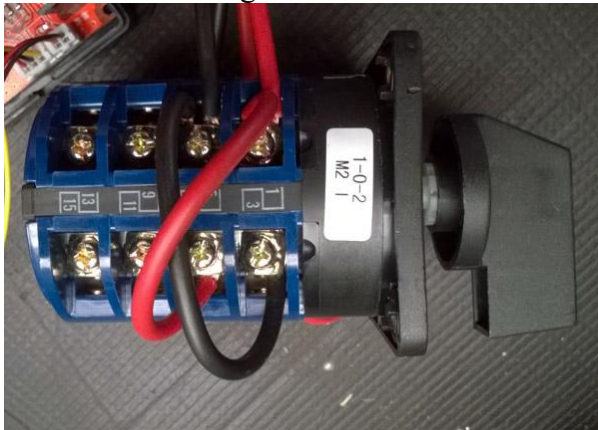
Red is positive, symbol +ve

Black is negative, symbol -ve.

This is what you are aiming to fit into the switch box. The supply from the battery box comes in from bottom right (socket not yet fitted), through the grommet to the connector block, from the connector block to the controller, then via to the reversing switch and back to the connector block. The wires to the motor leave through the hole in the footplate, which is suitably protected with a length of grommet strip to prevent the wires from chafing. The connector block sits above the footplate level but the wires should be left long enough to let it be pulled down through the hole for easy testing.



Follow the markings on the controller terminals rather than the diagram, they do vary in position.



The positive wire from the controller goes to terminal 1, then loops to 7. The negative goes to 5 and loops to 3. Turn the switch over and connect the output wires, positive to 2 looping to 4 and negative

to 6 looping to 8. When the switch is turned one way positive connects to positive and negative to negative, centre position is off and the other way positive connects positive to negative and negative to positive to give reverse.

A rather tricky bit is to fit an M4 x 10 screw into the hole in the box top from below, then hold it in place while you screw a nut onto it. The screw needs to be trimmed to leave about 2mm of thread exposed beyond the nut and the end cleaned of sharp edges, in this photo it had yet to be trimmed. The screw provides a positive stop for the new control handle, which replaces the normal control knob. The new handle provides enough leverage to break the plastic stop inside the potentiometer, thus allowing you to go past 'stop' to 'full speed', with interesting results. To prevent this the handle incorporates a lug which engages with the top of this screw and protects the delicate potentiometer, so ignore it at your peril.



The control handle



To bend the controller handle to shape place a 6mm drill in the vice with about 7mm projecting, pop the handle over it and place a 5mm drill behind it as shown. Holding the 5mm drill down with your thumbs use your fingers to pull the top part back as tightly as possible over the 5mm drill until it sits with the 6mm hole above the top of the 6mm drill. It may need a bit of gentle persuasion with a rubber mallet.

The bottom part has two bends in it to bring the parts together, these are simply done with a pair of pliers. The two small lugs are bent down close to ninety degrees as shown here. An M5 x 25 screw and nyloc nut serve to clamp the handle onto the spindle of the potentiometer.

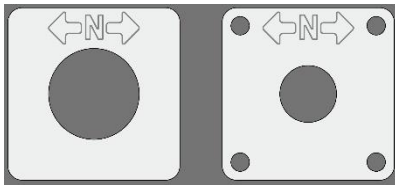




The upright of the handle is formed from an M5 x 25 screw, with a 16mm diameter ball knob screwed on. A further screw clamps the handle to the potentiometer spindle, making sure that its travel matches exactly the travel of the potentiometer and that it hits the screw acting as an end stop at the same time as the internal stop reaches the end of it's travel.

Cut a hole in the end of the plastic control box to make room for the wires, then pop the potentiometer into place in the hole on the top of the switch box and gently tighten the retaining nut. Snap the control box lid shut and fix it in place inside the control box with either double sided tape or preferably self adhesive magnetic tape where shown.

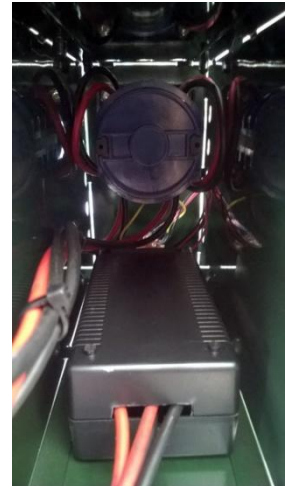
Undo the screw in the top of the knob on the reversing switch and pull the knob off.



Type A

Type B

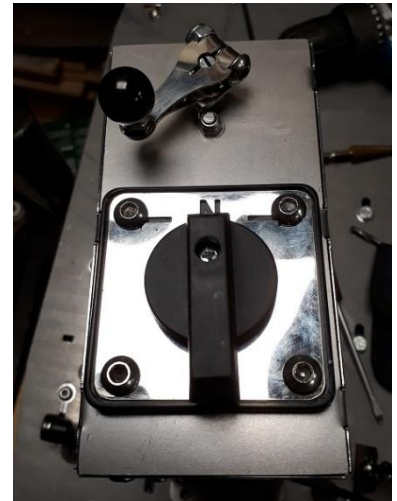
There are two different models of reversing switch, I have called them Type A with a plastic centre spindle and nuts inserted into the body, and type B with a square steel spindle and the nuts supplied loose.



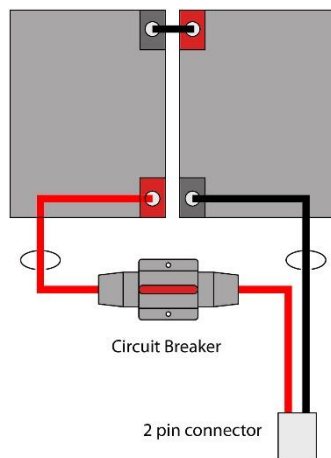
Type A. Spring out the black ring in the middle and release the silver plastic insert. You can now fit the switch into the control box with the screws included in the box, first pop the knob back on to check that you have got it the right way round (pointing to the speed control) as it only fits on the spindle one way. The body of the switch has trapped nuts, don't press too hard on the screw as you drive it in or the nut may push out and it is a very fiddly job trying to get it back in. Once the black plastic cover is screwed up fit the new stainless insert, pop the black ring back in to hold it in place and refit the knob.



Type B. This type has a square steel shaft and the knob will fit on any of four ways, so the alignment of the switch doesn't matter. Prise out the silver plastic top and replace it with the stainless top with the four holes in it. The separate nuts are almost impossible to fit, so fit it with four M6 x 16 button screws, just drive them into the holes in the plastic body.

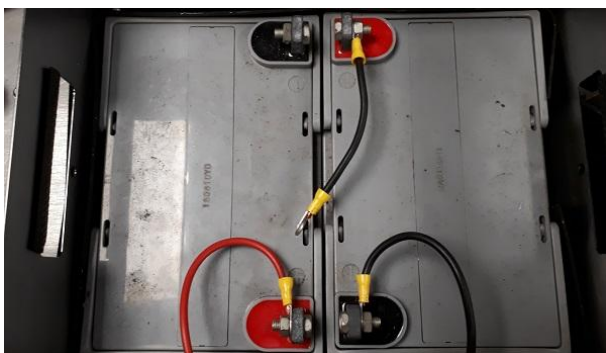


The wires from the controller and switch are led out of the control box through the hole in the footplate, which needs a strip of edge trim running round it to prevent the wires from chafing on the sharp edges, sufficient wire should be used to allow the connector block to be pulled below the footplate for testing. The wires from the battery box connector enter the control box through a grommet fitted into the hole low down at one end. The control box is mounted to the footplate by dropping four rubber 'well nuts' into the holes in the footplate, placing the box on top and inserting four M6 x 16 screws and washers through the holes in the box. As the screws are tightened the rubber well nuts swell up and grip the footplate. They act as a useful isolator to keep excess vibration away from the controller.

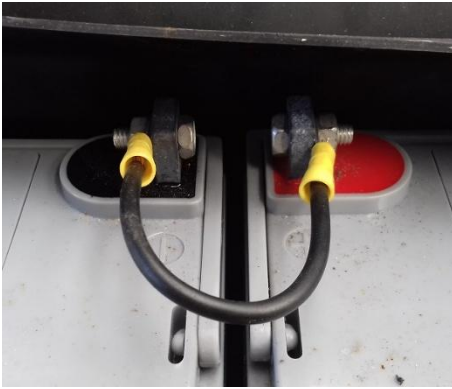


The wiring diagram for the battery box.

Screw the breaker into place with M3 screws pushed through from the inside and cut off any protruding screw. Add the grommets to the holes. Cut a piece of thin rubber matting or sheet to line the bottom and sides of the battery box and try lowering the batteries into place. The batteries are a tight fit in the box as the box was designed to fit under the existing Scamp bonnets. You might find that you need to use a pair of side-cutters and a file to shorten the protruding ends of the rivets to make sure that they won't rub and possibly wear their way through the battery sides.

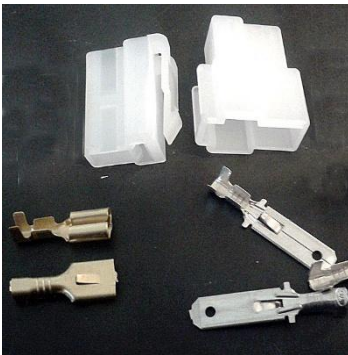


Run a 4mm red wire from the nearest positive terminal through a hole punched through the grommet to one end of the breaker and from the other end of the breaker to the connector. Make sure that the wire is long enough to reach the bottom of the box, where it will mate up with the connector on the controller. Run a black cable from the negative to the other side of the connector. Finally connect a wire between the two terminals on the other ends of the batteries, it is now live so be careful. For safety I prefer to leave this last connection unmade until everything else is finished.



I use crimped ring connectors and I also bought the more expensive proper crimping tool to ensure that I got a well crimped joint that is capable of handling the currents involved.

I like to protect the external wiring with either tubing slipped over before adding the end connections, or spiral wrap as seen here. I suggest that whenever you are not using the Imp that you press the test button on the breaker and set it to open, rendering the loco electrically dead.



This is the type of connector used. You will need a different crimping tool to make a proper connection. If you find that you have a problem getting the wires to stay put then solder them in place for extra security.

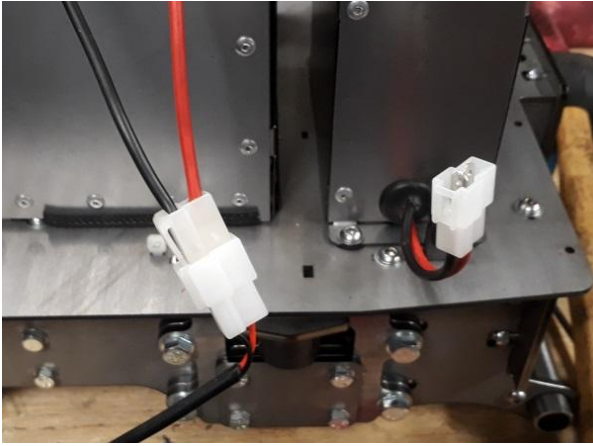
The smaller plug is connected to the battery box wires as it's terminals are protected from accidental contact. I put the positive terminal to the vertical and negative to the horizontal on all my locos so that battery boxes will fit on any of them.

A length of M6 'allthread' is pushed through the holes in the ends of the box and a washer and nyloc nut added to each end. I certainly recommend rounding off the end threads as they are quite good at removing skin.



If you haven't already done it add two strips of edge trim to the upper edges of the lifting slots in the ends to protect your hands and a couple of lengths round the base to protect the paint on the footplate.

Cut the plug off the 24v wire on the mains battery charger and use a meter to find out which wire is the positive and which the negative. Using one half of the second 2 pin connector and making sure that you match the polarities, make a connection with the connector you have just put on the battery box output wires. To charge the batteries you simply unplug the battery box from the control box and connect it to the charger instead. As you can see, the black wire on this charger was actually the positive!



Do make sure that the breaker is closed when connecting the charger, as if it is left open the charger will still show a green light as though the batteries are fully charged but the batteries will not be charging. I fitted a battery monitor to the prototype, but as a charge will last a full weekend's playing I removed it as superfluous. Due to it's weight you need to think about adding an extra securing strap to hold the battery box in place when you move the loco in the back of a vehicle.



If required the foot operated 'dead man's' switch seen in the photo is pushed up from underneath and it's rubber cap screwed on. It is connected into the wires to the motor.

You may have to extend the motor wires so that they can reach the switch and the connector block at the base of the controller, clip them up out of the way using cable ties through the holes provided. Never operate the reversing switch unless the loco is at rest with the control knob switched off, the stop will be so sudden it may throw you off and things may go bang. Once you let the smoke out things stop working!

The optional slatted seat

The seat frame is assembled as shown with the small stretcher at the top of the back, using M6 x 16 screws, thin washers and nyloc nuts.



You may wish to round off the edges of the slats, to do this I screwed my router to the underside of a piece of plywood and used a 6mm radius cutter with a guide roller to round off all the edges. The timber is always fed into the left side of the cutter, so that the timber is being pushed back towards you rather than being pulled out of your hand. Radius the long edges first, then the long ends, then the short. This minimises splitting.



The slats are assembled to the frame in the same way as the steelwork with M6 x 35 flanged button head screws into nyloc nuts. Use your finger tips to locate the nuts evenly in the holes while passing the screws through, there are points on the frames which bite into the wood as the bolts are tightened. The bolts bottom in the hole to prevent the timber from being crushed. Finish to your choice, I used a breathable wood stain. The seat simply hooks into the slots in the footplate.



The frame is fitted with nine strips of 25mm x 50mm 'planed all round' timber each about 400mm long as seat slats. These need holes drilling accurately to match the centres of the side frames using the drilling template supplied.

Painting

I prefer to build and test, then strip and paint when I get some decent weather as I prefer to spray paint and for me this means working outdoors. You may prefer to build up the steel assemblies, paint them and then bolt on the rest of the parts. If so I suggest making up the following assemblies for painting; wheels, axles and sprockets with axle ends masked up where the bearings and collars fit, complete frame with layshaft fitted (with coupling fronts removed at first to prime inside, then refitted), battery box, control box, seat frame, axleboxes, horn pieces, brake rigging and bonnets. If you are spraying then don't let any paint get inside the bearings.

Reassembly

After painting reassemble the loco as above, add plastic tube end caps to the brake lever and derailing bars, and if you wish add trim round the edges of the bonnets and a mat on the floor where your feet will rest. Cut a length of the heatshrink tubing to fit the brake handle, slip it on and heat it with a hairdryer on hot to shrink it in place.

The battery box is held in place on the footplate by two well nuts placed in the holes in the brackets projecting above the footplate, M6 x 16 screws are fitted in the well nuts and the box drops over them and slides sideways to lock, the screws then being tightened. With the battery box lifted off it is a lot easier to lift the frame into the back of a car or turn the frame over for maintenance. Even though there is a 'dead man's' foot pedal fitted, it is safest to check that the controller is in the 'neutral' position before connecting the battery box.

The seat is placed over the box and simply clips into holes in the footplate.

Maintenance

The occasional drop of oil is needed on sliding surfaces, the sides of the axleboxes, the brake lever pivot, the moving parts of the latch, and the teeth of the quadrant. Chains are best lubricated with a spray chain lubricant, turn the frame over and push a few layers of newspaper under the chains, spinning the wheels by hand while spraying for full coverage. Wipe off the excess once the solvent has flashed off to avoid dirt sticking to it.

Keep an eye on the brake cable to see that there are no broken strands, replace it immediately if you do find one, it is your only means of stopping! Do make sure that you use the correct heavy duty cable, not bicycle brake cable. Brake shoes should last for years, and are easily adjusted by taking up the slack in the cable adjuster beneath the lever or releasing the cable end clamp on the brake beam and taking up the slack in the cable. They should not be allowed to run too slack as they will start to chatter and the brake cable will sag and allow the parts to dig into the track.

Play time!

Driving the Imp is a matter of pushing down the foot operated switch with your heel and then using the direction control, throttle knob and brake lever and hopefully a certain number of brain cells as well. Do not operate the reversing switch unless the loco is at rest, and do not turn the controller on before putting your heel on the 'dead man's' switch if fitted, sudden starts and stops are best avoided on a loco with such a short wheelbase as it may lead to a derailment.

Shopping list for the Imp, search Ebay for most of the parts.
In all cases refer to the photograph.
The price guide refers to the total number of the item required, not each.

Part of the design ethos of the loco is to use easily available commercial parts for all the items which may wear out, so that spares can be easily and cheaply obtained.

20mm ERW Mild steel round tube with 2mm thick wall. 800mm

Axle bearings 6004 2RS 20 x 42 x 12	4 off
Layshaft bearings 6202 2RS 15 x 35 x 11	2 off



20 tooth taperlock sprocket 06B1 31-20 (fast)	
OR	
24 tooth taperlock sprocket 06B1 31-24 (medium)	
OR	
27 tooth taperlock sprocket 06B1 31-27 (strong)	2 off



taperlock bush 1210-20	2 off
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Springs - vibration isolators 30 dia x 20 thick	4 off
with male M8 thread one side. Search for 'vibration mounts'.	
(These come from China, delivery times of a few weeks are not uncommon)	



Brake shoes are available from PNP, www.pnp-railways.co.uk
 Search for their pack of four 7 1/4" narrow gauge brake shoes
 PNR-1E-7 1/4



One piece shaft collars, 20mm	4 off
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Vintage motorcycle heavy duty universal cable set for brakes as per photo	1 off
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Brake lever spring, Search '13.5mm OD compression springs' in ebay, find the photo, choose 1.0mm wire and 35mm long.	1 off
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Rubber edge trim (Flexible Metal Reinforced) 6.5mm – 9.5mm, Fits 1mm - 2mm	2m
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PAIR of 12v 33AH mobility scooter batteries

Maximum size 195 x 130 x 155 tall to top of terminals. Pair



12V DC 30 AMP Car Audio In-line Circuit Breaker 1 off



Terminals, crimp on ring connector, yellow 6 off

Red 2 off



Crimp on straight connector, yellow 2 off



2 pin connector, 6.3mm spade terminals 2 off

2mm cable tie for brake cable and wiring 10 off

20mm Black Rubber Blanking Closed Grommets, 3 off



Grommet strip suitable for 3mm thick panel, sample



20mm tube end cap / bung 5 off



24 volt 5 amp MOBILITY SCOOTER / WHEELCHAIR Charger



Heavy duty push button switch 20 amp (Optional) 1 off



Electric motor Reversing switch, 4pole, 32amp
as per photo

1 off



1mm thick Rubber sheet, 600mm x 500mm

1 off

9-50V 2000W MAX 40A
PWM DC Controller
As per photo. 1 off £10
(It is worth getting a spare as well)



Connector block, 30 amp,

6 way



Motor, 24v 350W Unite MY1016

1 off



4mm² cross section multi strand wire,
1 metre each of red and black

06B-1 ($\frac{3}{8}$ ") roller chain with spring link

1m

M6 x 20mm well nuts
(also known as motorcycle fairing nuts)

12 off



25mm x 50mm planed all round timber
@ 390 to 400mm long

9 off (for slatted seat)

75mm x 25mm Planed all round timber
long

2 off (for optional buffer beams) @370mm

Heatshrink tubing for brake levers, 25mm red,

100mm



Seat cushion, (plywood, foam, material), estimate
(These can be supplied finished, please ask for a price)

Fixings and fastenings

4mm x 10mm long aluminium pop-rivets	80 off
M4 x 20 socket head screw with washers and nyloc nuts	3 off
M5 x 25mm pan or button head screw with nyloc nuts	2 off
M6 'all thread'	300mm
M6 x 16 stainless button head screw	80 off
M6 x 35 flanged button head stainless screw	20 off (for slatted seat only)
M6 x 25 hex head screw bzp	5 off
M6 x 30 hex head screw bzp	30 off
M6 thin 'form B' stainless washer	150 off
M6 nyloc nut bzp	150 off
M8 x 30 hex head screws	20 off
M8 form b washer bzp	35 off
M8 nyloc nut bzp	20 off
M10 x 100 screw (coupling pins)	2 off
M10 nyloc nut if required	2 off