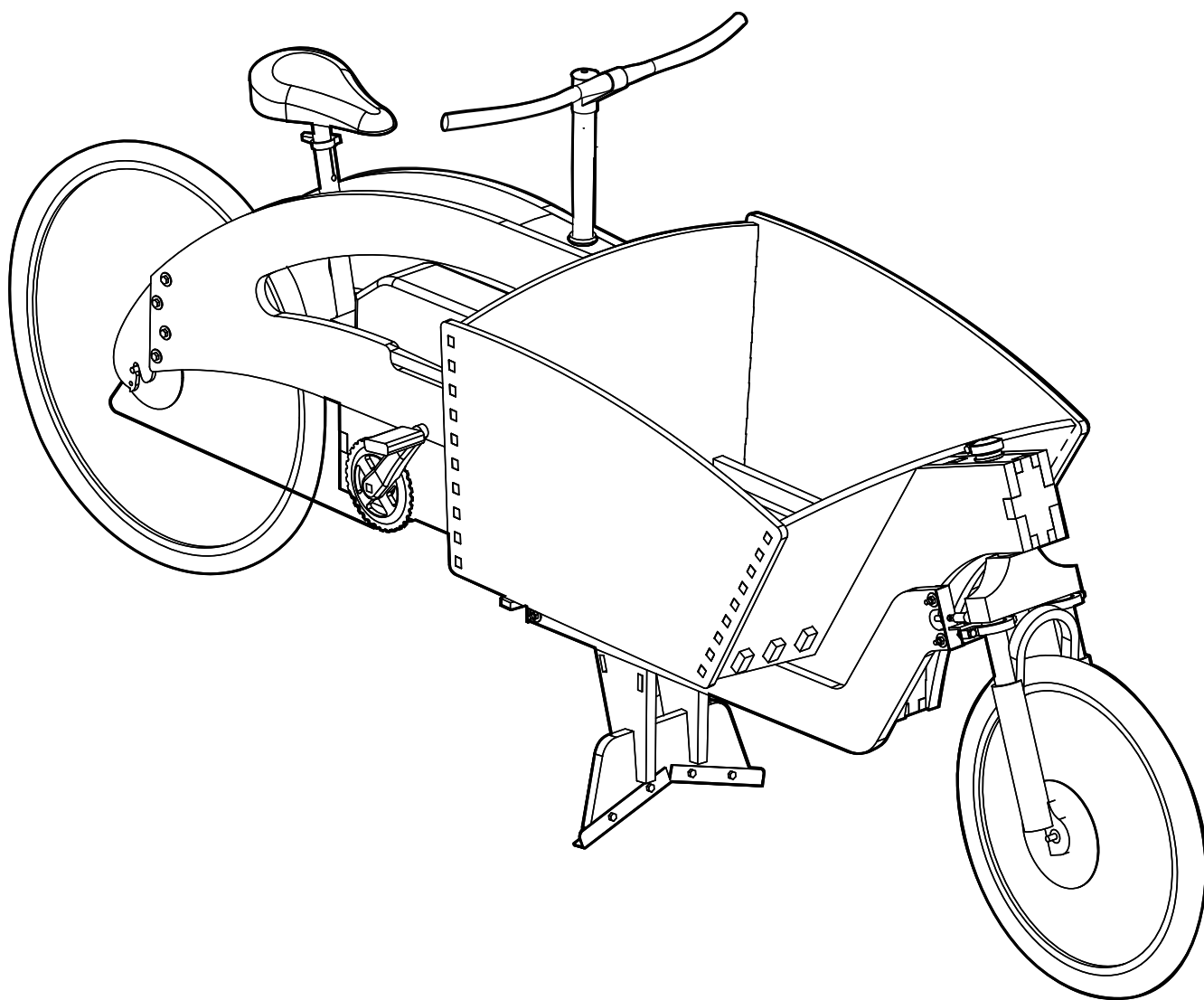


Long-John Plywood E-Cargo Bike Construction Manual



This manual describes the construction of both the short and the long versions, although the illustrations only show the short model.

Plywood E-Cargo Bike Construction Manual

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Making the Steering Connection Bar
Assembling the Steering Connection Bar
Making the Kickstand
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Making the Battery Panel
Wheels, Brakes, Gears, Grips, and Electrics
Bill of Materials
Images of cutting files
Photographs

Introduction

This manual describes how to build your own open-source electric plywood long john cargo bike. The project is based on the idea that sustainable transport should be accessible, affordable, and adaptable. By using widely available materials and openly shared knowledge, this design aims to empower individuals and communities to create a practical vehicle for everyday use while reducing environmental impact.

The cargo bike is designed primarily from plywood and standard bicycle components. Plywood is a renewable, resource-efficient material with a significantly lower environmental footprint than steel or aluminum when sourced responsibly. It requires less energy to produce, stores carbon during its lifetime, and can be worked with common woodworking tools, making it suitable for small-scale, local production and repair. Many parts of the bike can also be sourced from existing bicycles, encouraging reuse and extending the life of components.

The plywood frame components are cut from digital design files using a CNC router. Access to a CNC machine is therefore required to produce the main structural parts. Fortunately, CNC routers are increasingly available through makerspaces, fab labs, schools, and commercial workshops, making digital fabrication accessible to a growing number of people.

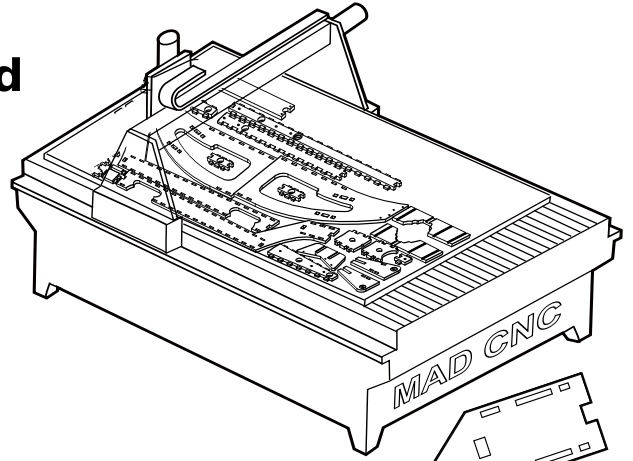
This manual deals specifically with the construction of the plywood frame. It focuses on the digital files, materials, machining, assembly, and finishing of the wooden structure. It does not cover in detail the installation or adjustment of bicycle systems such as brakes, gears, steering components, or electric motor systems; readers should consult other resources for these aspects.

The construction of this bike requires a combination of digital fabrication skills and relatively advanced woodworking techniques. However, no welding or metal machining is necessary. All structural elements are made from wood and commonly available hardware.

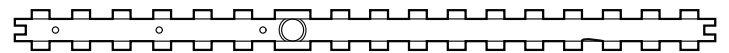
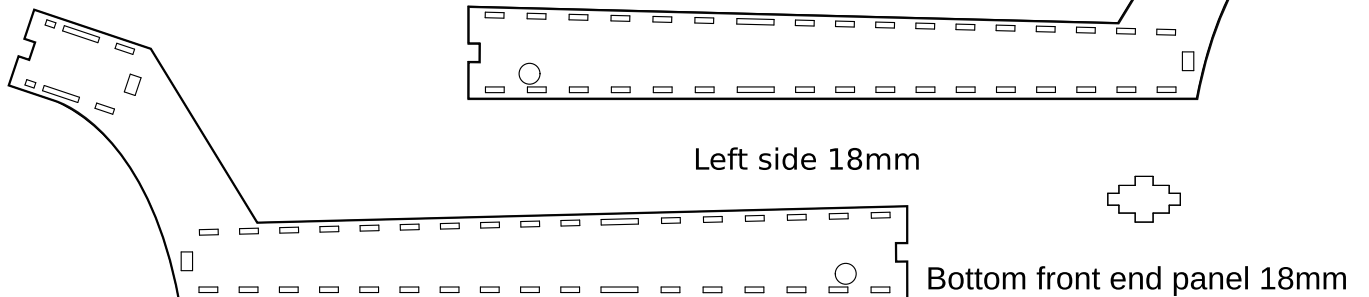
This design is fully open source and free to download, modify, and share. All files are released under the GPL (General Public License). As with all GPL projects, there is no warranty: you build and use this cargo bike at your own risk. The authors and contributors cannot be held responsible for errors, omissions, or any damage or injury resulting from construction or use.

Machining the 18mm Plywood

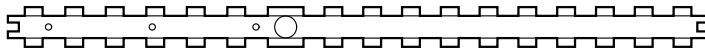
In the file system, find the dxf file called 'LongJohnShort18mmPlywoodPartsNested.dxf',
or
'LongJohnLong18mmPlywoodPartsNested.dxf'
and use your favourite G-code software
to generate the tool paths for your
CNC router. The CAD drawings are
optimised for a 4mm cutter. You will need to
add tabs to each component.



Front Frame



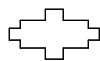
Bottom panel 18mm



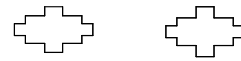
Top panel 18mm



Top and bottom front panel 18mm

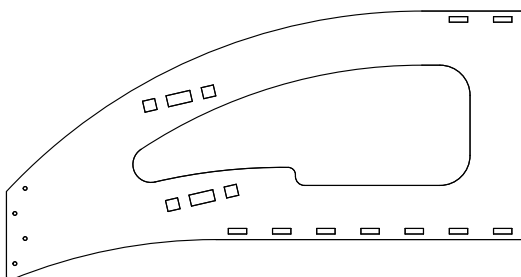


Bottom rear end panel 18mm

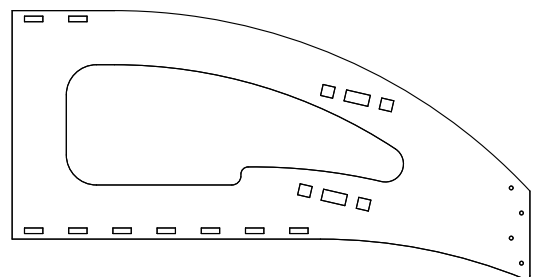


Top end panels 18mm

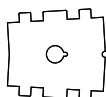
Rear Frame



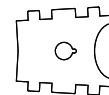
Left side panel 18mm



Right side panel 18mm



Seat brace top 18mm



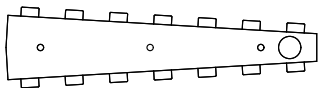
Seat brace bottom 18mm

Machining the 18mm Plywood (cont.)

Rear Frame (cont.)

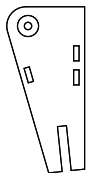


Top panel 18mm

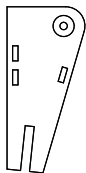


Bottom panel 18mm

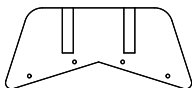
Kick stand



Left side panel 18mm



Left side panel 18mm



Foot Panel 18mm



Front panel 18mm



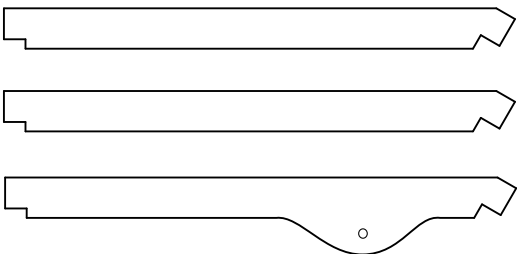
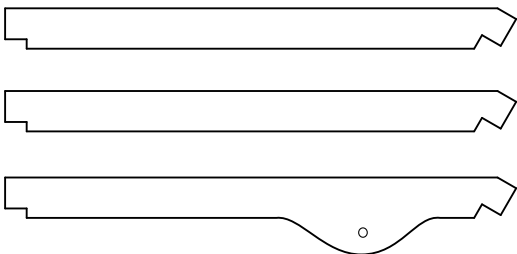
Cross bar 18mm

Steering connection bar



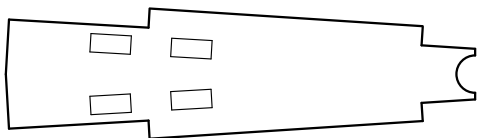
Steering connection bar 18mm

Front bucket

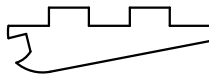
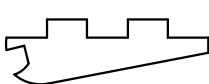


Front bucket floor strips 18mm

Plywood battery plate



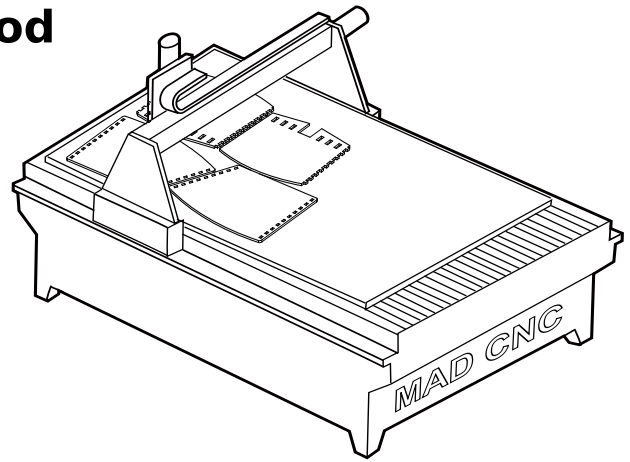
Top panel



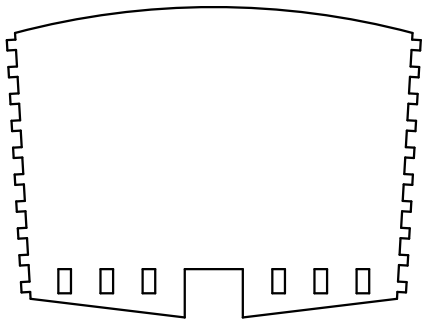
Sides

Machining the 12mm Plywood

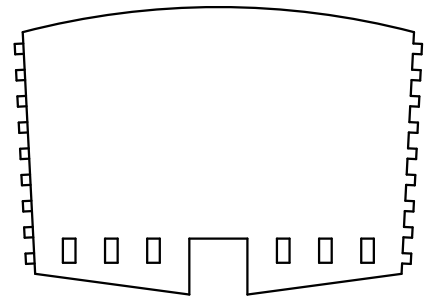
In the file system, find the dxf file called 'LongJohnShort12mmPlywoodPartsNested.dxf',
or
'LongJohnShort12mmPlywoodPartsNested.dxf',
and use your favourite G-code software to generate the tool paths for your CNC router. The CAD drawings are optimised for a 4mm cutter. You will need to add tabs to each component.



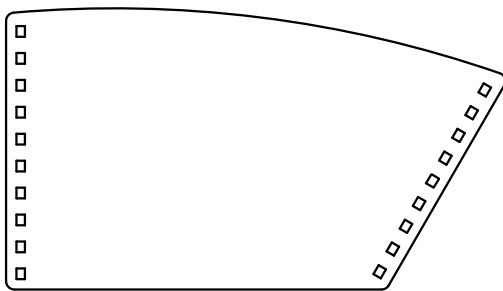
Front bucket



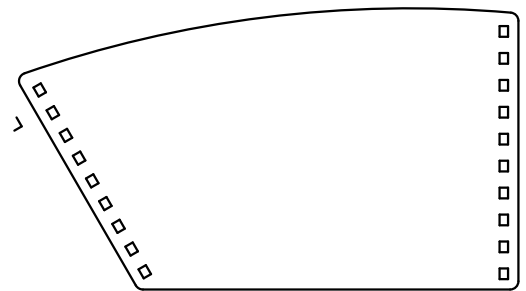
Back panel 12mm



Front panel 12mm



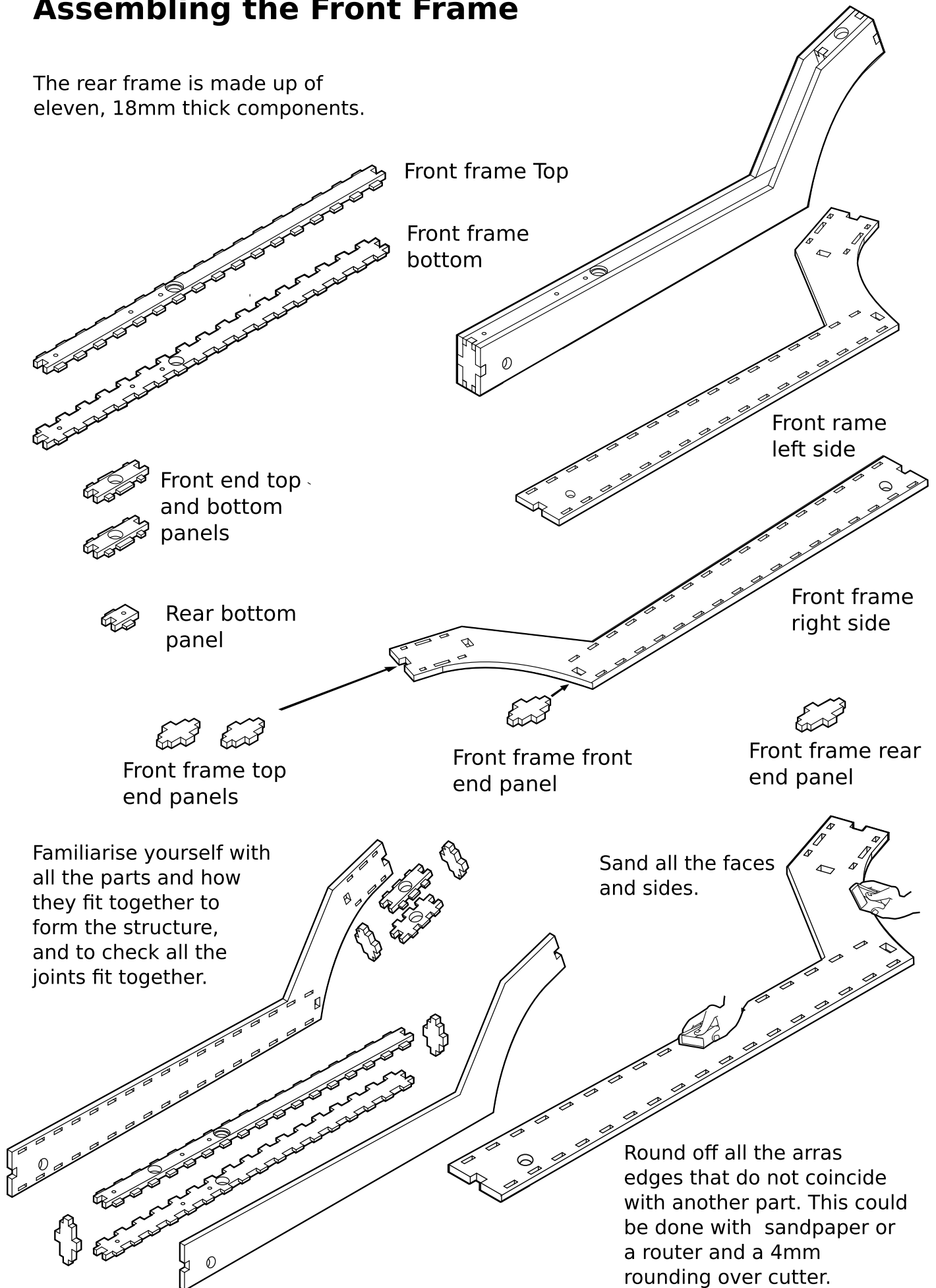
Side panel 12mm



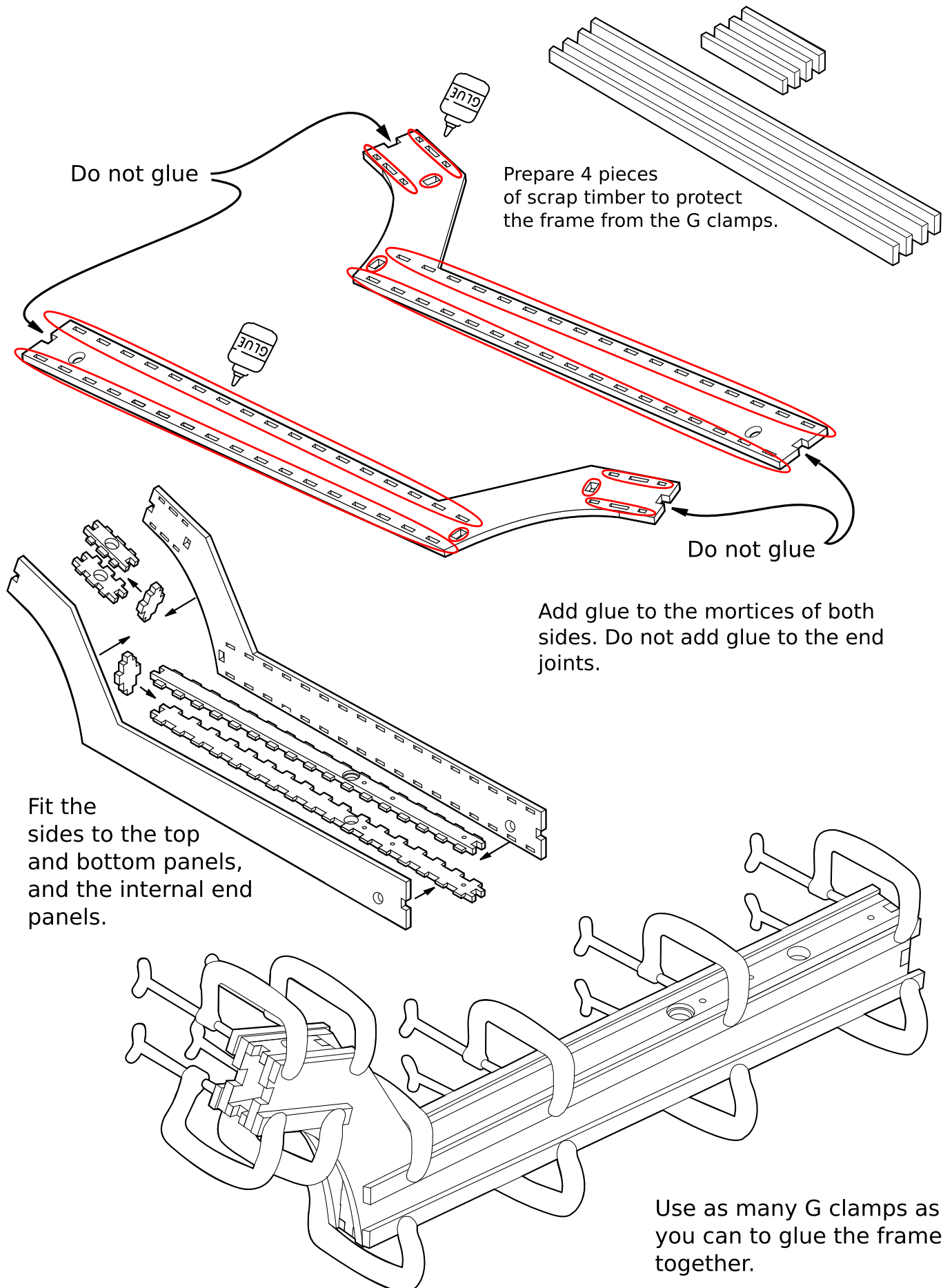
Side panel 12mm

Assembling the Front Frame

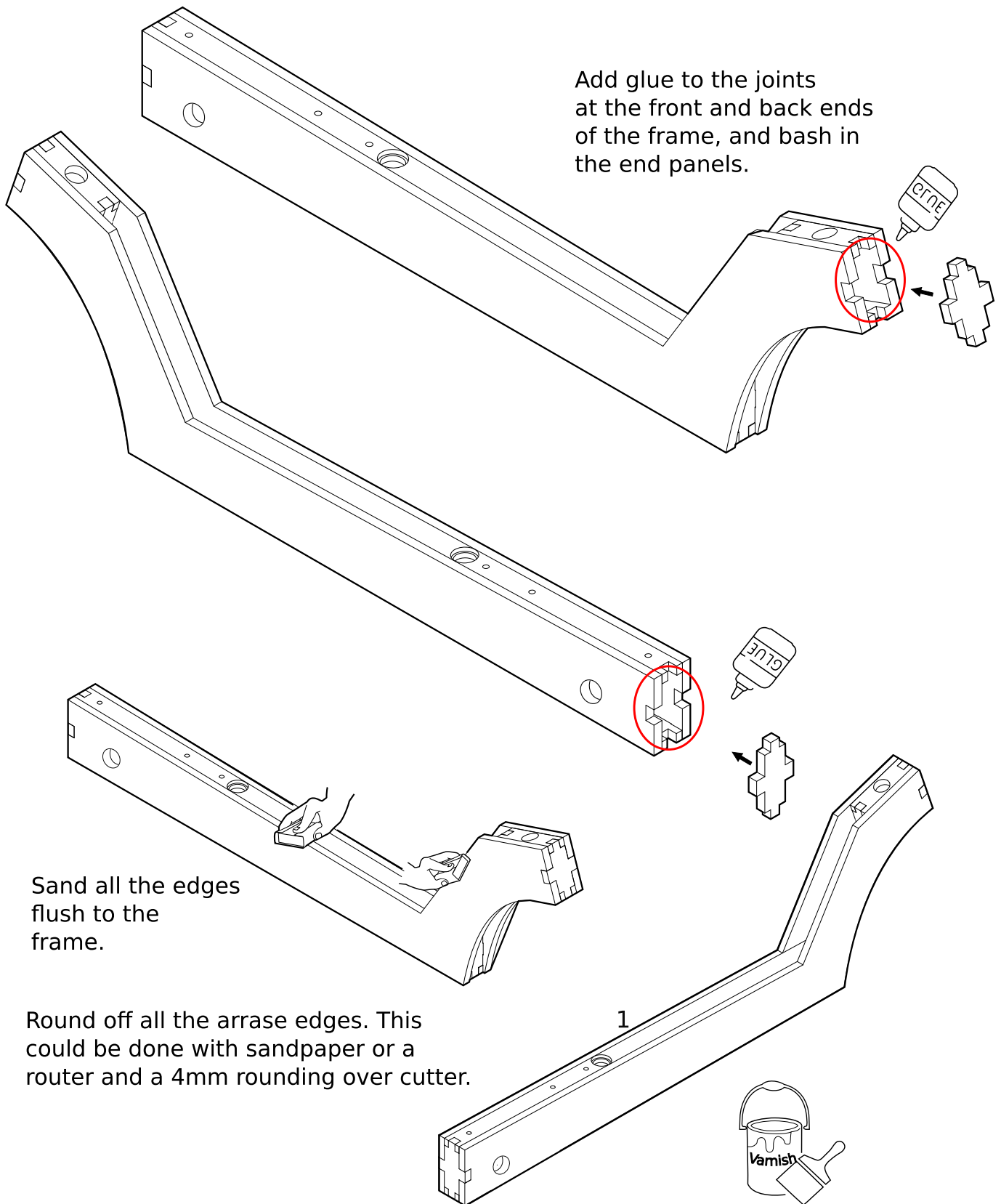
The rear frame is made up of eleven, 18mm thick components.



Assembling the Front Frame (cont)



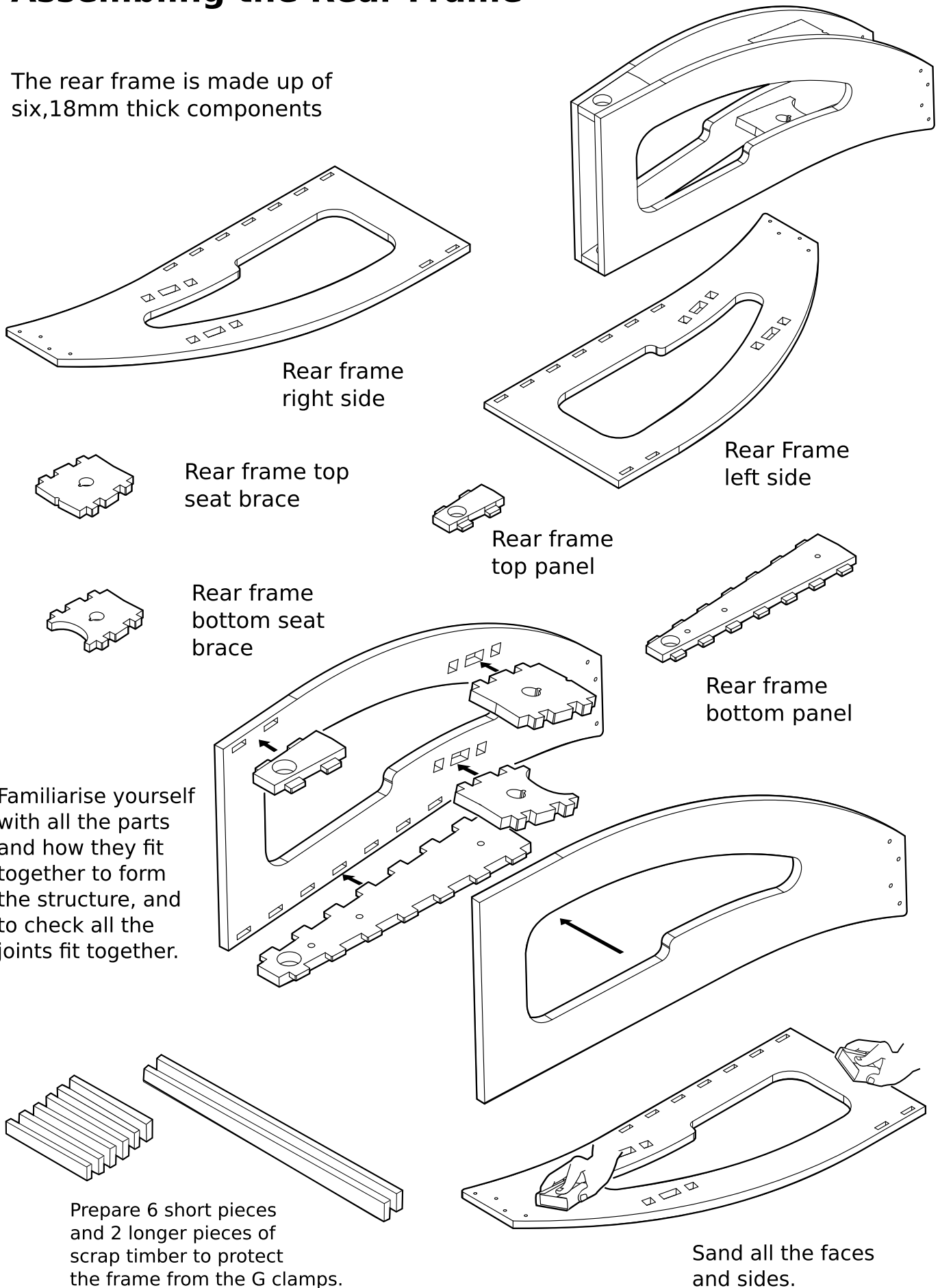
Assembling the Front Frame (cont.1)



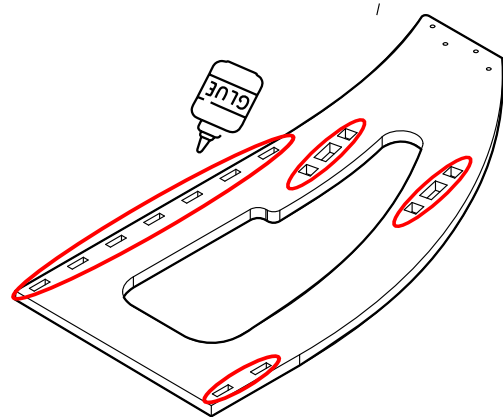
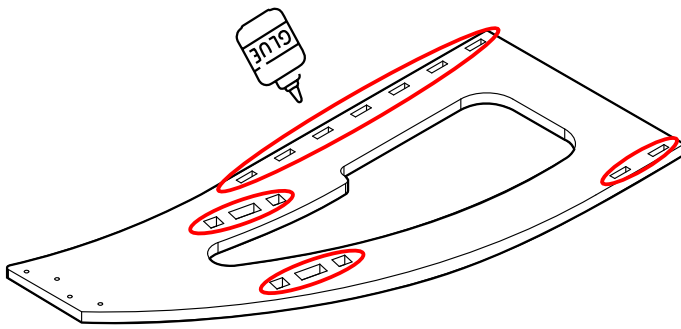
Add 3 or 4 coats of varnish.

Assembling the Rear Frame

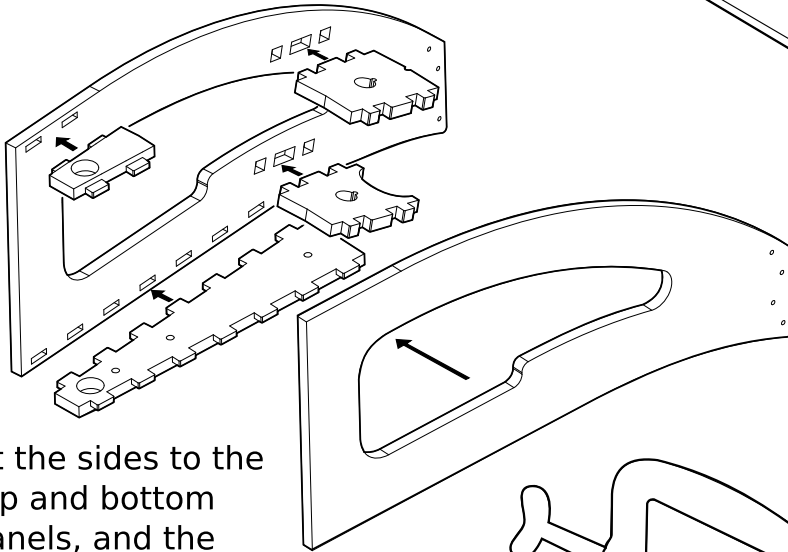
The rear frame is made up of six, 18mm thick components



Assembling the Rear Frame (cont.)

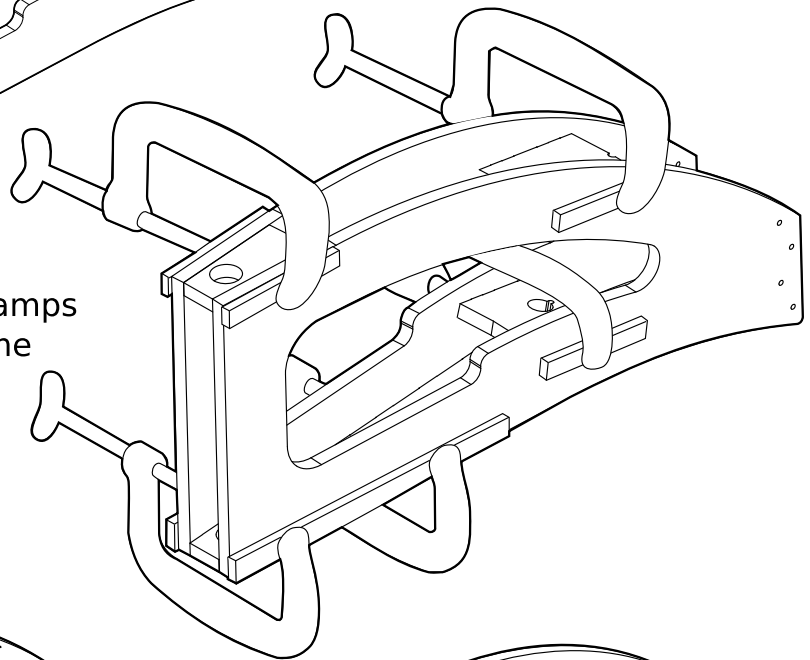


Add glue to the mortices of both of the sides.

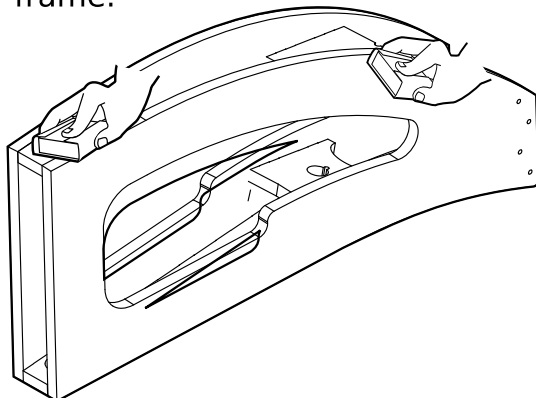


Fit the sides to the top and bottom panels, and the seat braces

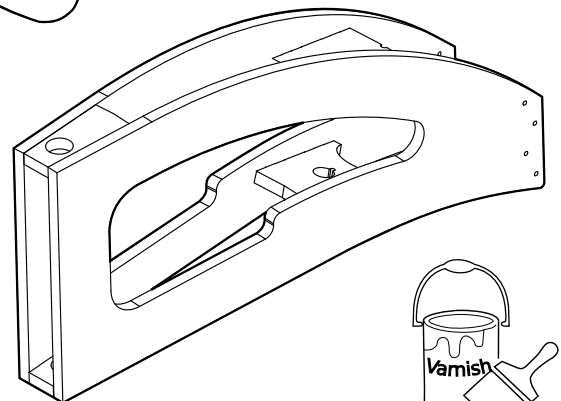
Use at least 5 clamps to glue the frame together.



Sand all the edges flush to the frame.



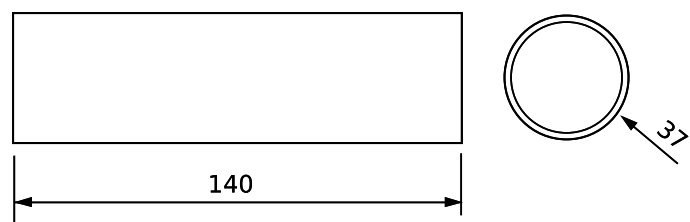
Round off all the arras edges. This could be done with sandpaper or a router and a 4mm rounding over cutter.



Add 3 or 4 coats of varnish.

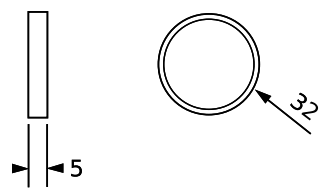
Steering Tubing

Head Stock Tube



This tube is embedded into the front frame of the bike and takes the headset bearing cups.

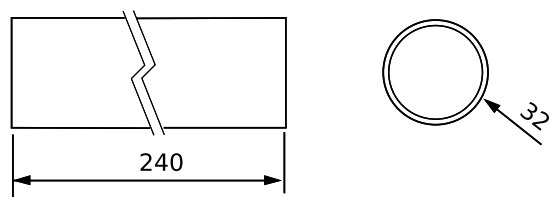
Front Steering Tube Sleeve Stainless steel



This tube is placed over the steerer tube of the forks and below the headstock assembly. The length will depend on the length of the steering tube.

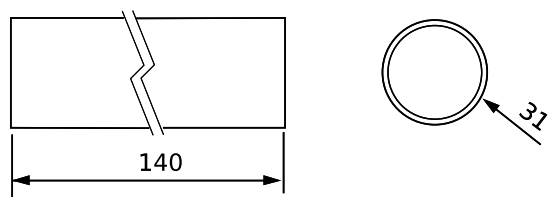
Mid Steering Tube Sleeve, Top

Stainless steel



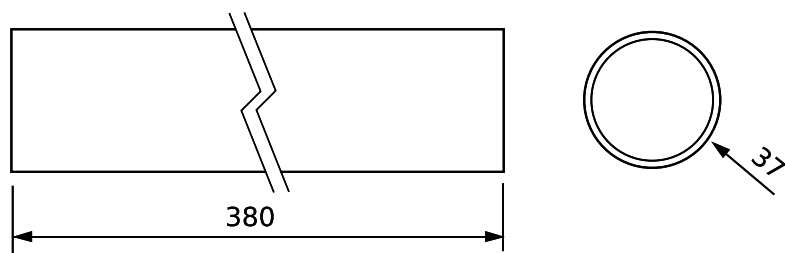
Mid Steering Tube Sleeve, Bottom

Stainless steel



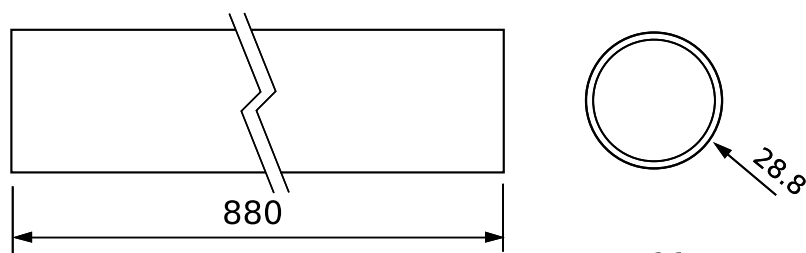
These tubes are placed over the long mid steerer tube, below the handlebar stem, and above the mid steerer lever.

Mid Steering Bearing Tube Mild steel bike tubing



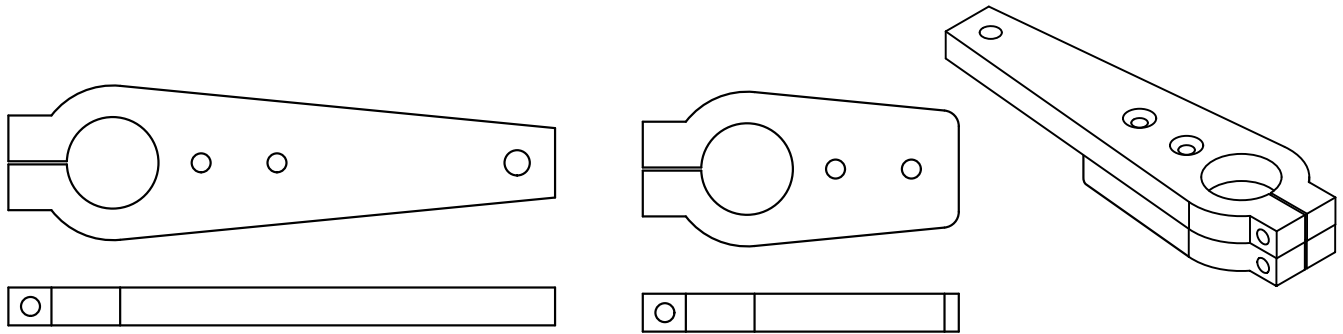
This tube is embedded into the rear frame of the bike, and takes the head set bearing cups.

Mid Steering Tube Stainless steel tubing



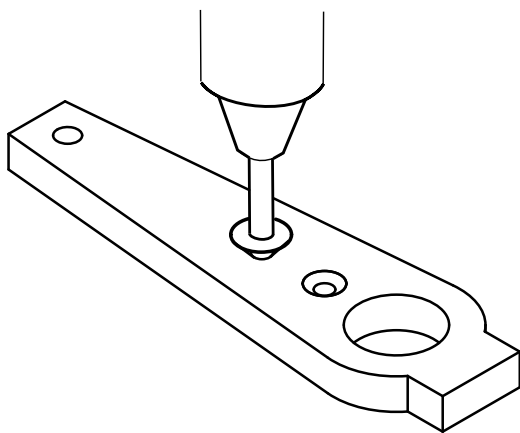
This is the main steering tube that goes from the handlebars to the mid steering lever.

Mid Frame Steering Lever

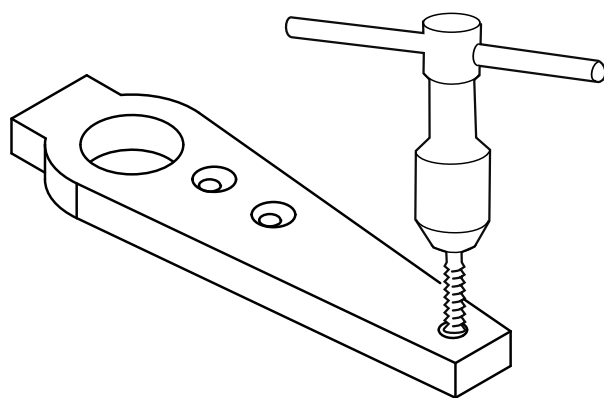


The mid frame steering lever is made from 2 pieces of 12 mm thick aluminium plate. Laser cut or milled from the file called '12mm AliPartsNested.dxf'. These parts have to be drilled and tapped, hacksawn and bolted together.

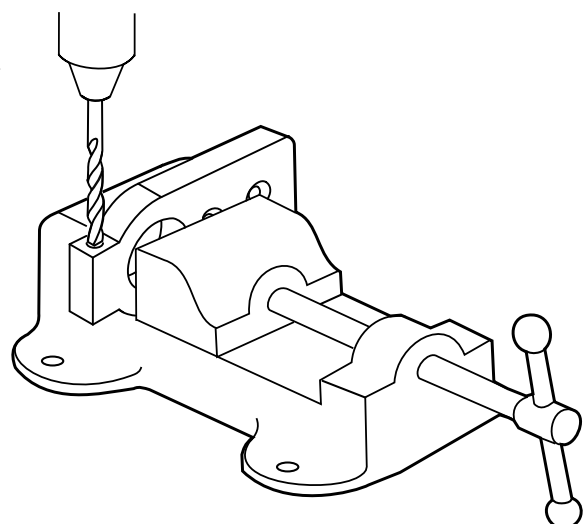
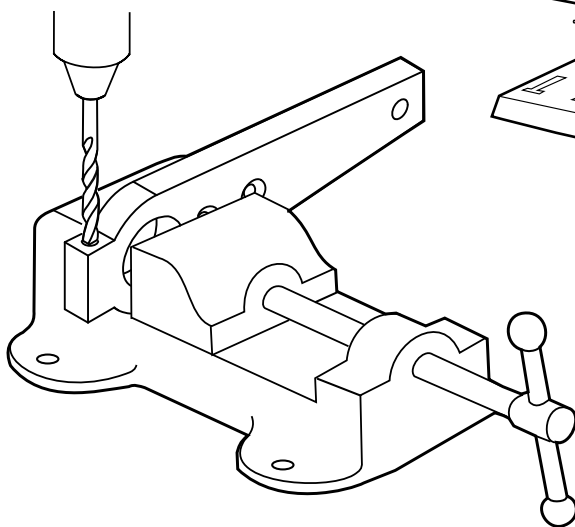
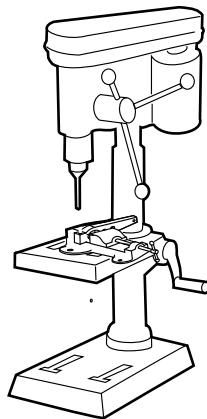
.dxf'



Countersink the two 6mm holes to take the countersunk hex head bolts

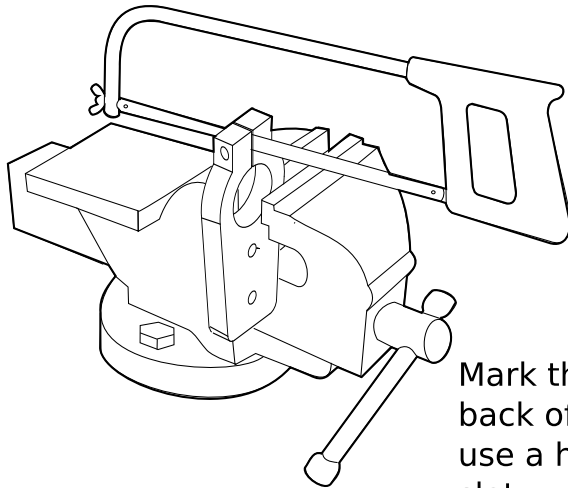


Drill and tap the hole at the end of the lever for an M8 x1.5 thread

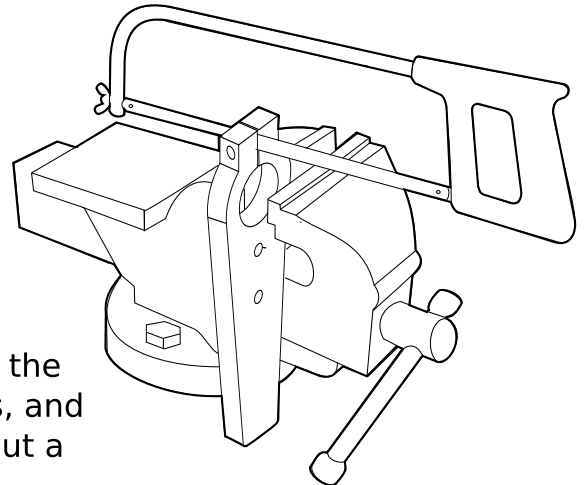


Carefully mark and centre punch for the 6mm holes in the middle of the flat at the back of both pieces of the lever. Drill the holes, preferably with a drill press.

Mid Frame Steering Lever (cont.)

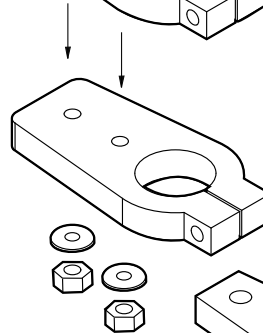
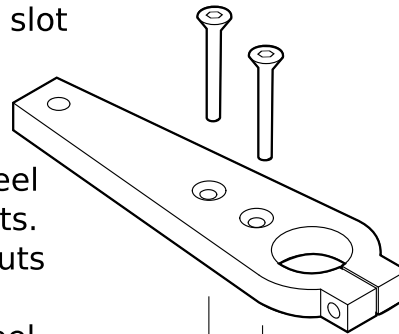


Mark the middle of the back of both levers, and use a hacksaw to cut a slot

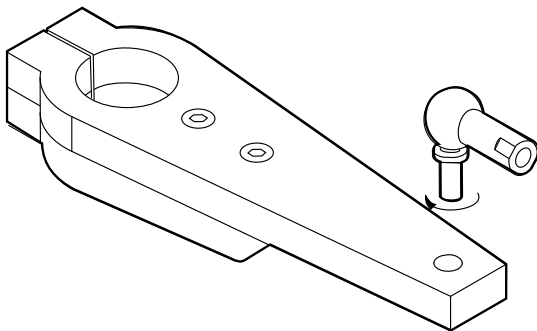


You will need:

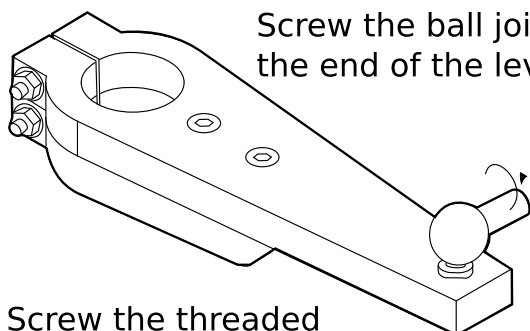
- 2 pcs M6 x 20 Stainless steel countersunk cap head bolts.
- 4 pcs. M6 stainless steel nuts and washers
- 2 pcs M6 x 25 stainless steel hex head bolts
- 1 pc. M8 ball joint
- 1 pc M8 x 120mm stainless steel threaded rod.
- 2 pcs M8 nuts and washers.



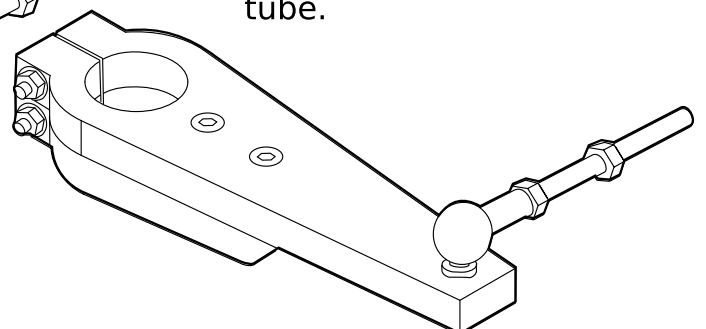
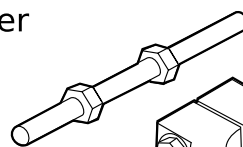
Bolt the two parts of the lever together with the M6 x 20 stainless steel countersunk cap head bolts, nuts, and washers.



Screw the ball joint into the end of the lever

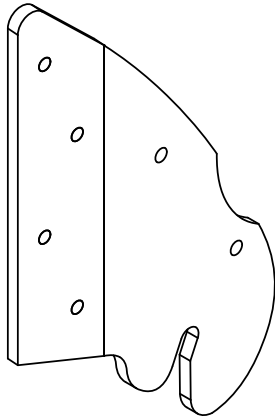


Screw the threaded rod into the ball joint, and add a couple of nuts

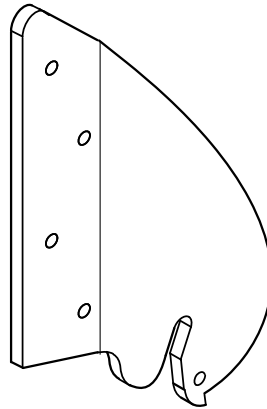


Add the 2 M6 x 25 hex head bolts, nuts, and washers. This will clamp the lever to the steering tube.

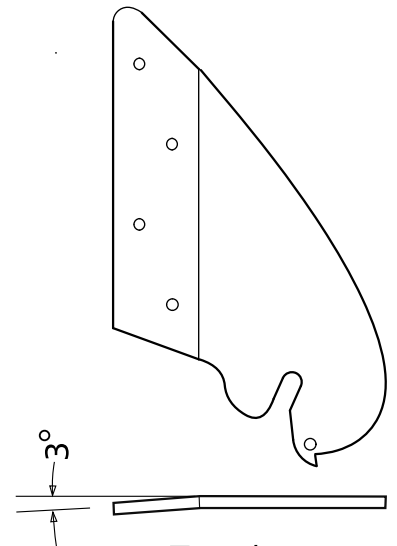
Rear Dropouts



Brake side dropout

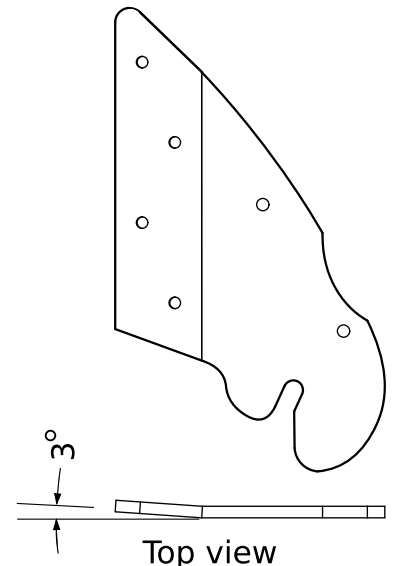
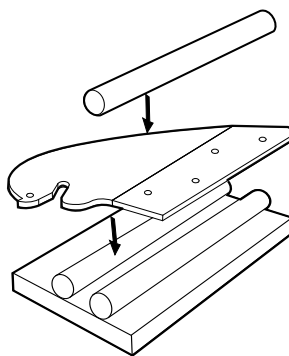
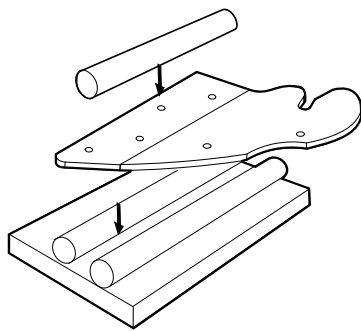


Gear side dropout



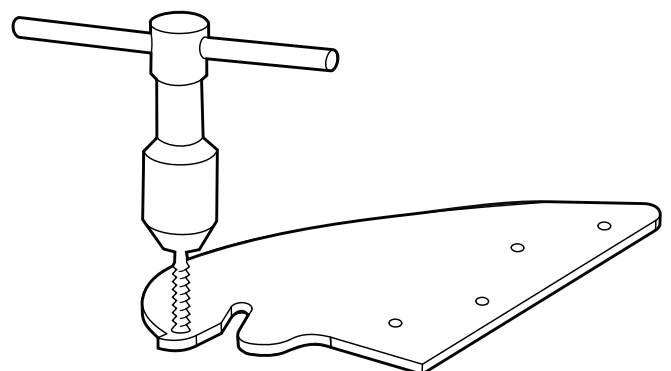
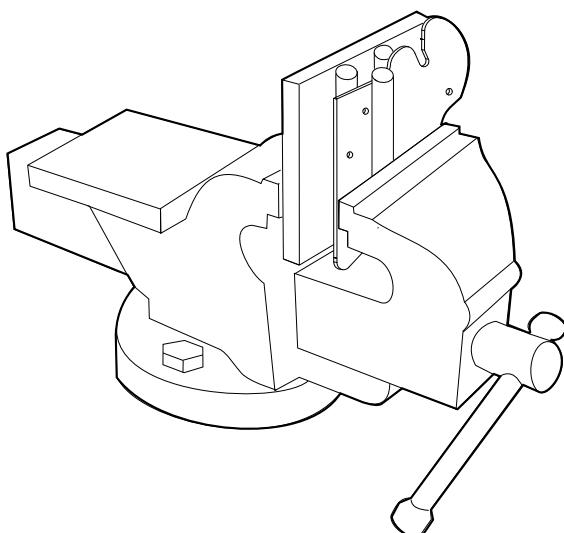
Top view

The rear dropouts are made from 6mm thick aluminium plate, laser cut or milled from the file called DropoutsNested.dxf. They have to be bent to an angle 3 degrees in opposite directions.



Top view

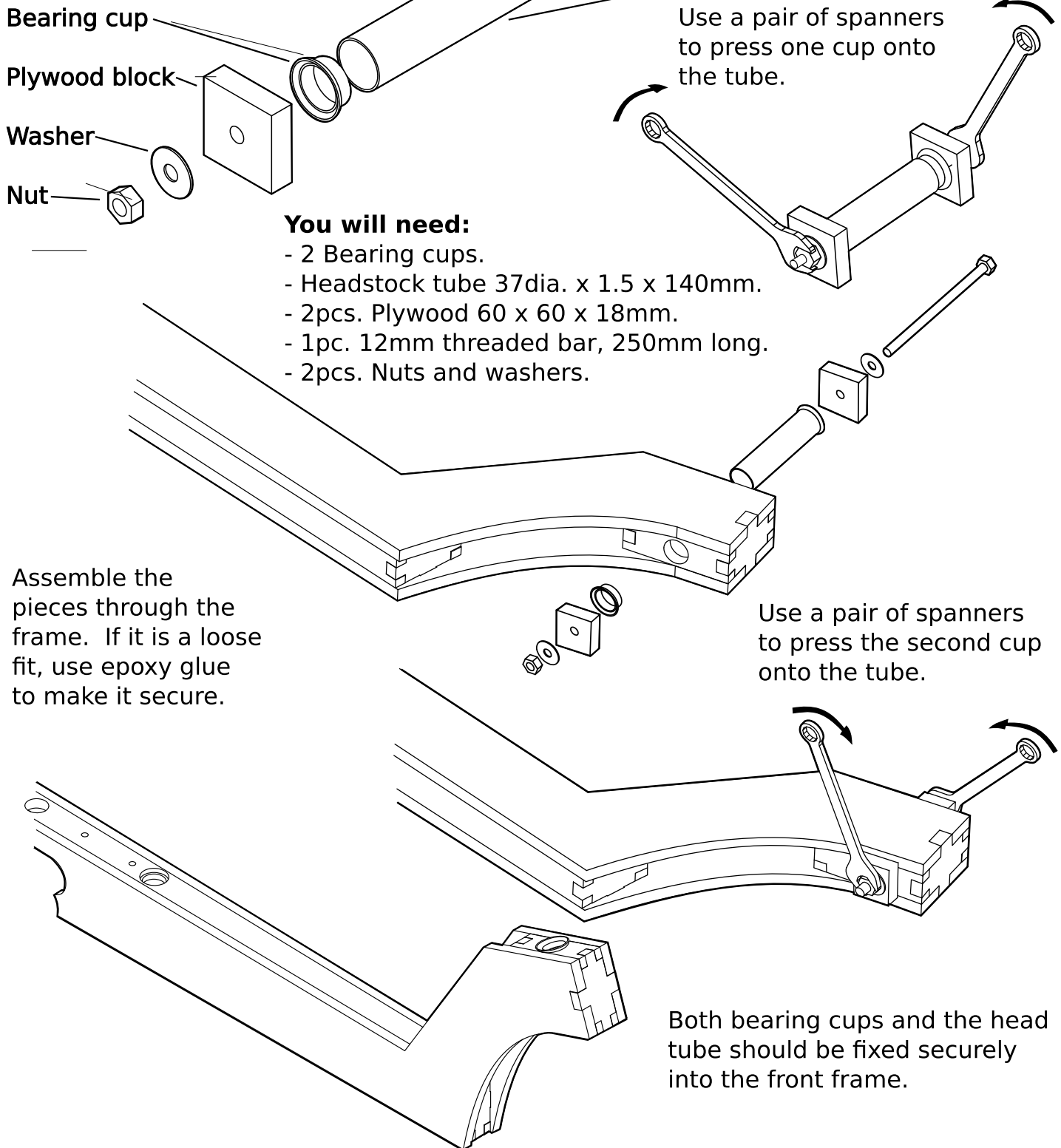
Some laser cutting companies will be able to bend these components. If you have to do this yourself, make a jig from 3 pieces 12mm dia. steel rod, and a piece of steel plate. Place the jig and the dropout in a large metalwork vice and apply pressure.



Carefully drill and tap the gear sidedrop out for an **M10 x 1** thread to take the derailleur bolt.

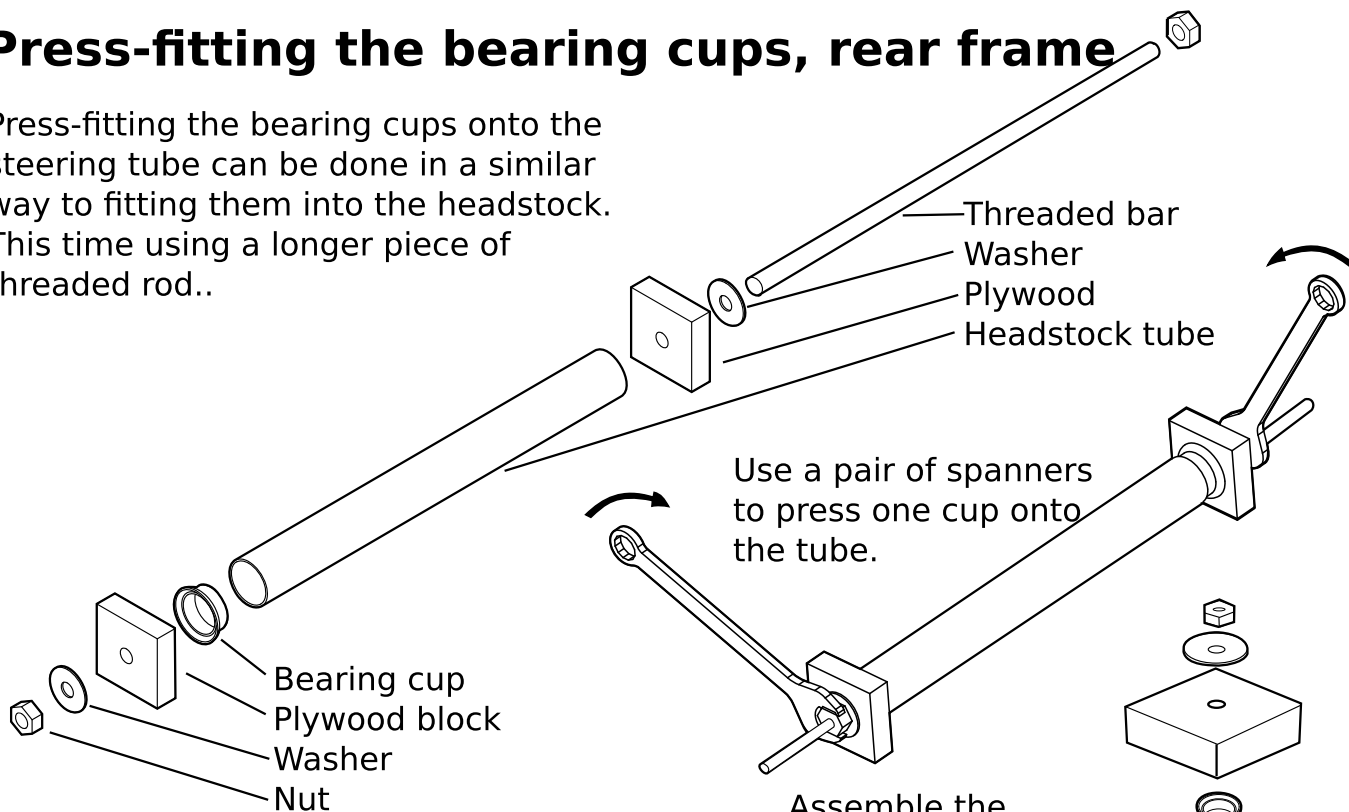
Press-fitting the bearing cups, front frame

Press-fitting the bearing cups onto the headstock tube is a bit tricky. It can be done with a pair of sash clamps, but it is probably better to make a special clamp from two pieces of plywood, a length of 12mm threaded rod, and some nuts and washers.



Press-fitting the bearing cups, rear frame

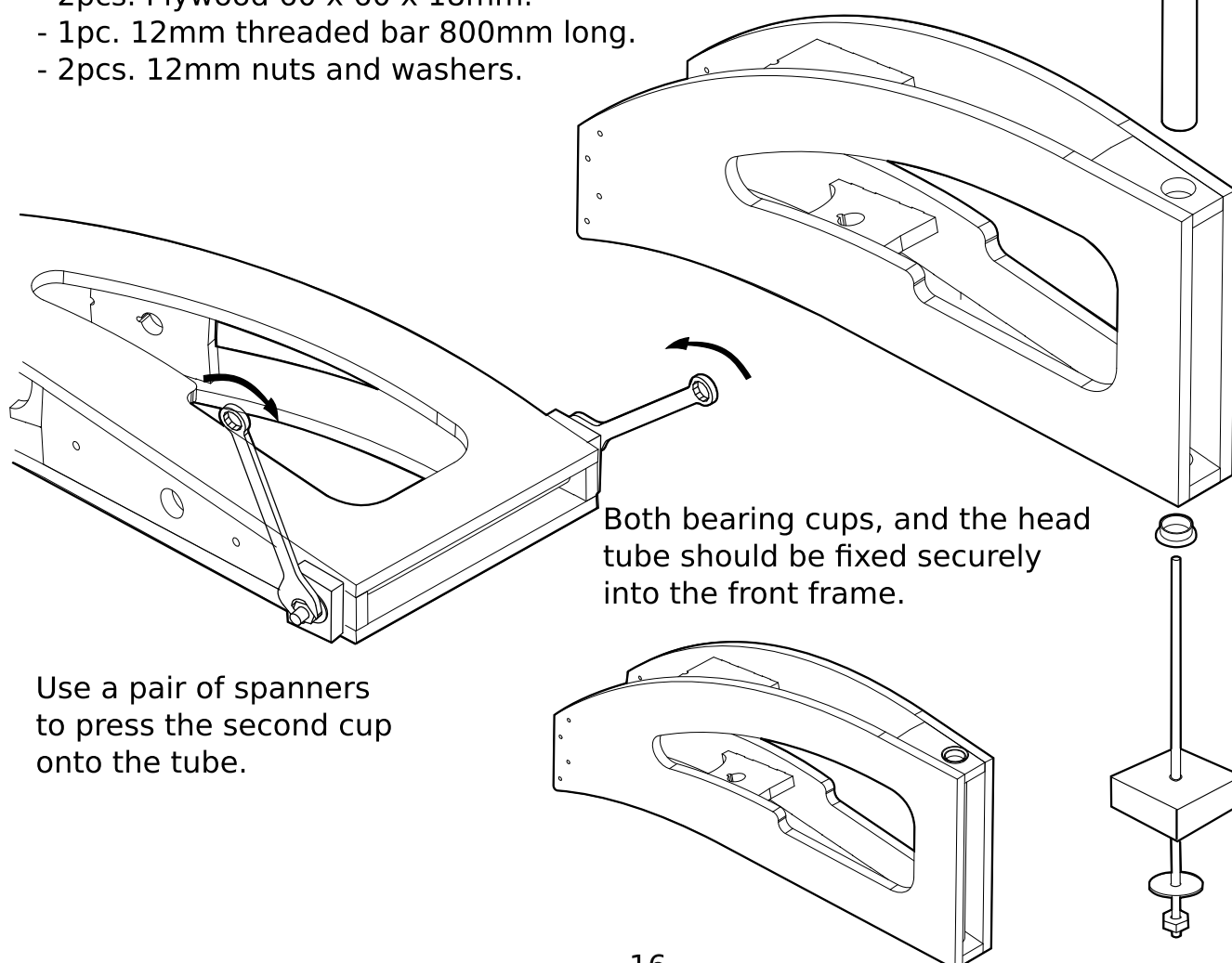
Press-fitting the bearing cups onto the steering tube can be done in a similar way to fitting them into the headstock. This time using a longer piece of threaded rod..



You will need:

- 2 Bearing cups.
- Headstock tube 37dia. x 1.5 x 380mm.
- 2pcs. Plywood 60 x 60 x 18mm.
- 1pc. 12mm threaded bar 800mm long.
- 2pcs. 12mm nuts and washers.

Assemble the pieces through the frame. If it is a loose fit, use epoxy glue to make it secure.



Assembling the front and rear frame

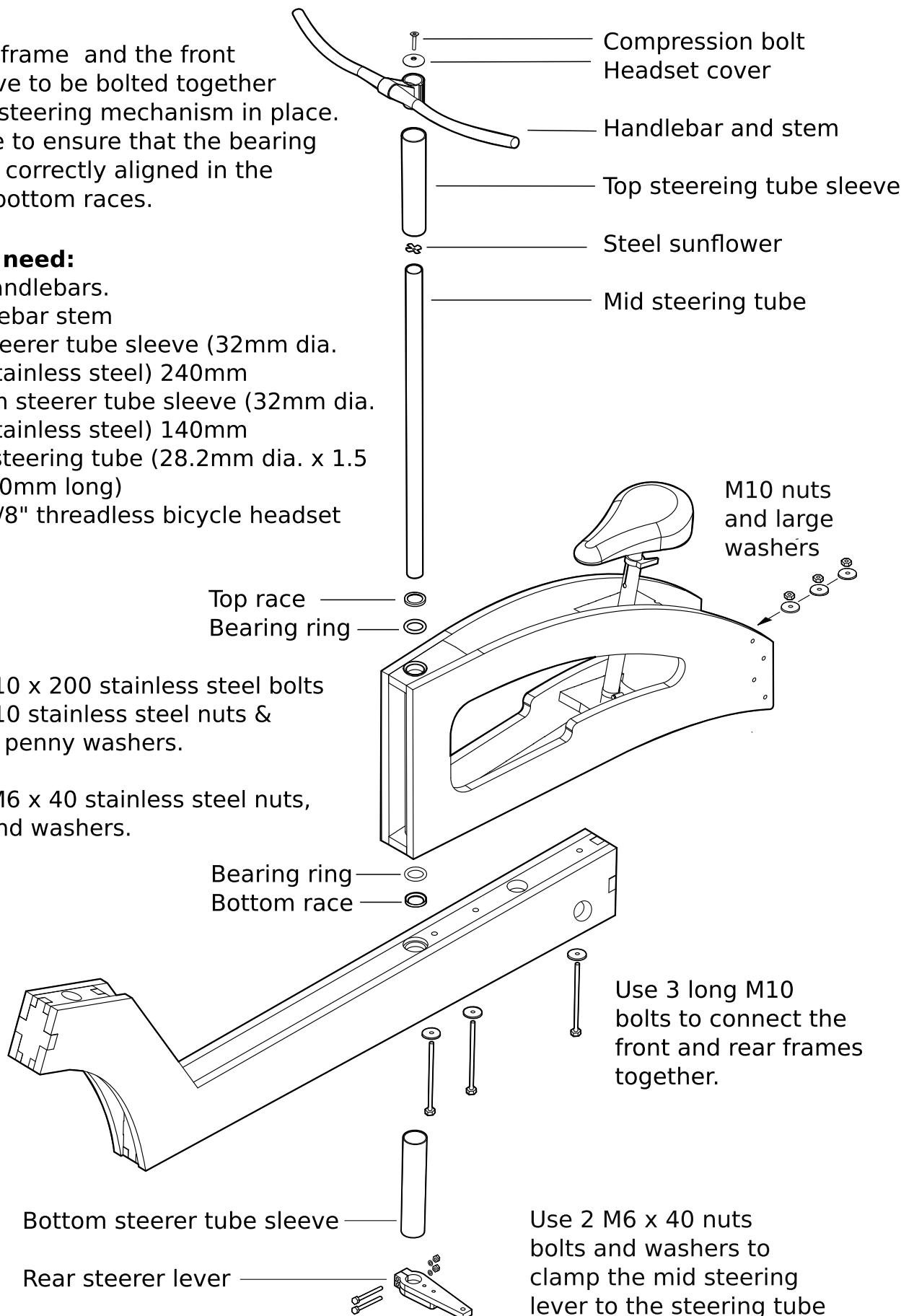
The rear frame and the front frame have to be bolted together with the steering mechanism in place. Take care to ensure that the bearing rings are correctly aligned in the top and bottom races.

You will need:

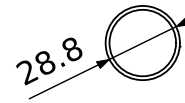
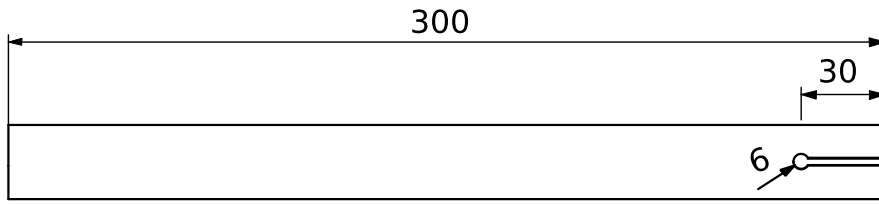
- 1 set handlebars.
- 1 handlebar stem
- 1 top steerer tube sleeve (32mm dia. x 1.5 stainless steel) 240mm
- 1 bottom steerer tube sleeve (32mm dia. x 1.5 stainless steel) 140mm
- 1 mid steering tube (28.2mm dia. x 1.5 tube 880mm long)
- 1pc. 1 1/8" threadless bicycle headset

- 3pcs M10 x 200 stainless steel bolts
- 3pcs M10 stainless steel nuts & 6 large penny washers.

- 2 pcs. M6 x 40 stainless steel nuts, bolts and washers.

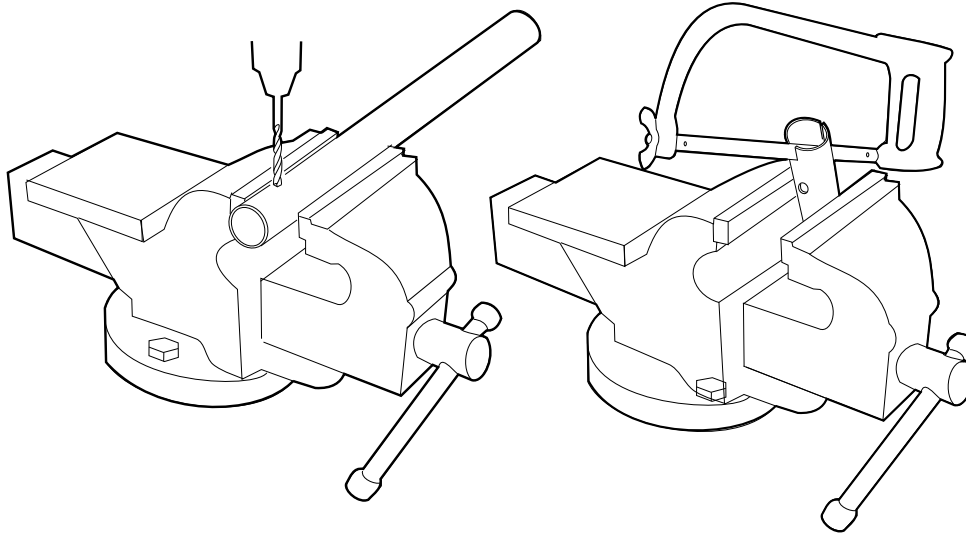


Seat Stay

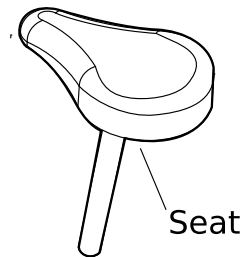


The seat stay is made from a piece of stainless steel tube 28.8mm dia.x1.5mm thick.300mm long.

Drill a 6mm dia. hole right through the tube, 30mm from the end.



Cut a slot in the top of the tube to allow the seat post clamp to compress the tube.



Seat

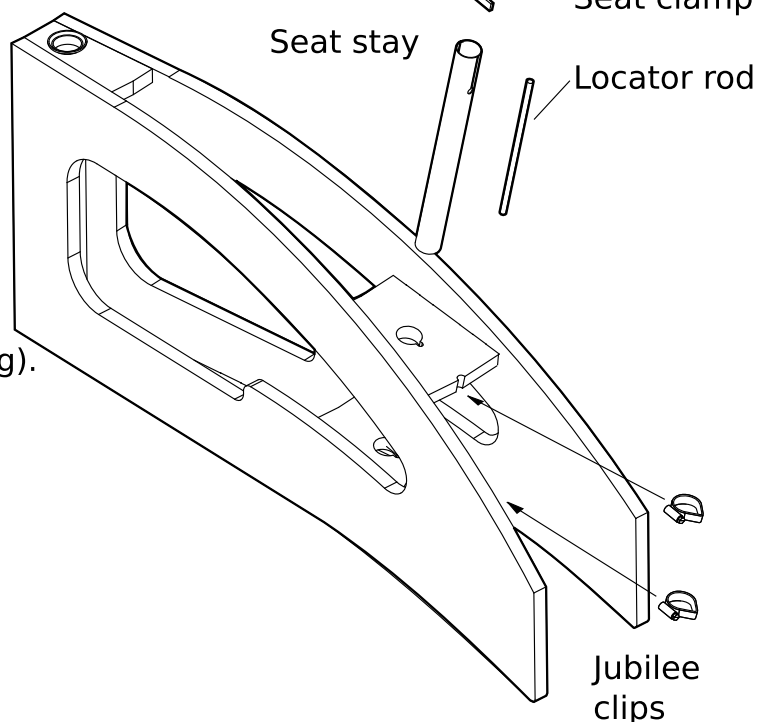


Seat clamp

Assembling the seat stay and seat

You will need:

- 1 Seat and seat post.
- 1pc. 28.8mm diameter seat clamp.
- 2pcs. 30mm diameter jubilee clip. (these hold the seat stay and locator rod in position).
- 1pc. locator rod. (6mm dia. x 220mm stainless steel rod. (This stops the seat stay rotating)).
- 1pc. Seat stay. (28.8mm dia, x 1.5 stainless steel tube 300mm long).

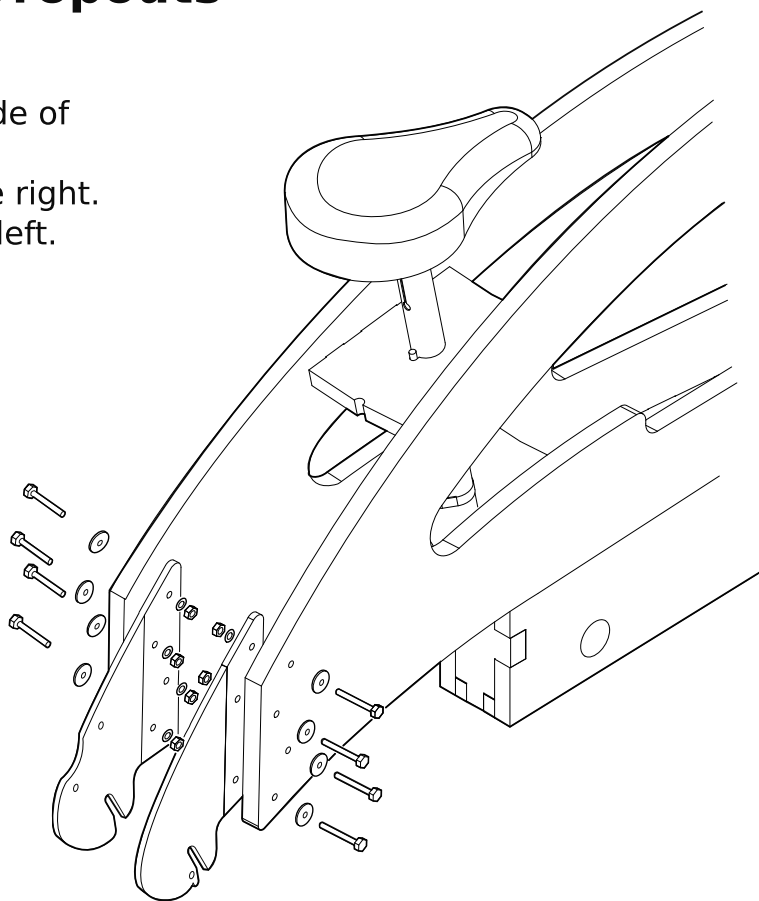


Bolting on the Rear Dropouts

The dropouts are bolted to the inside of the frame.
The brake-side dropout goes on the right.
The gear-side dropout goes on the left.

You will need:

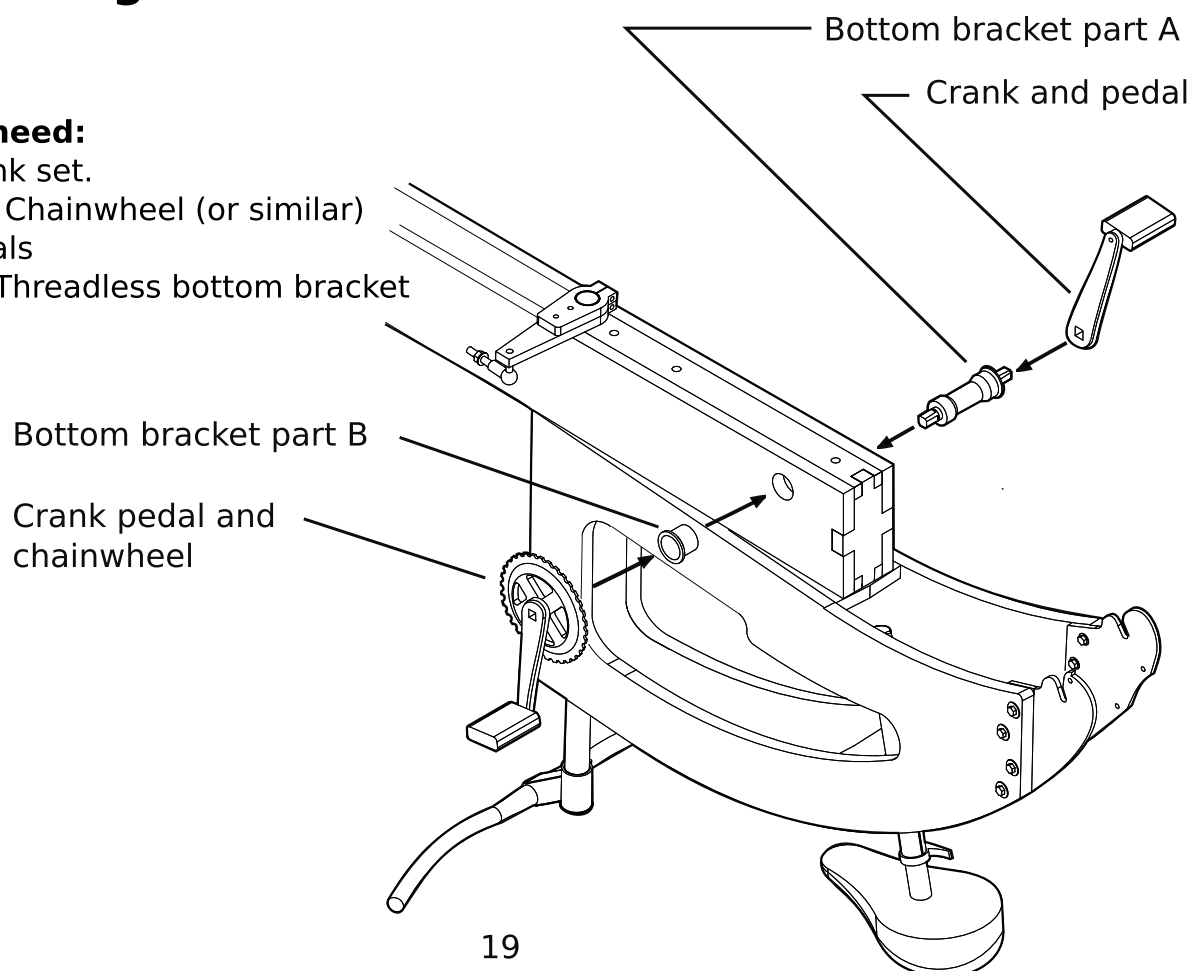
- 8pcs. M6 x 35 stainless steel bolts.
- 8pcs. M6 stainless steel nuts.
- 8pcs. Large stainless steel penny washers (these go against the plywood frame).
- 8pcs. stainless steel washers. (these go against the aluminium brackets).



Assembling the Bottom Bracket

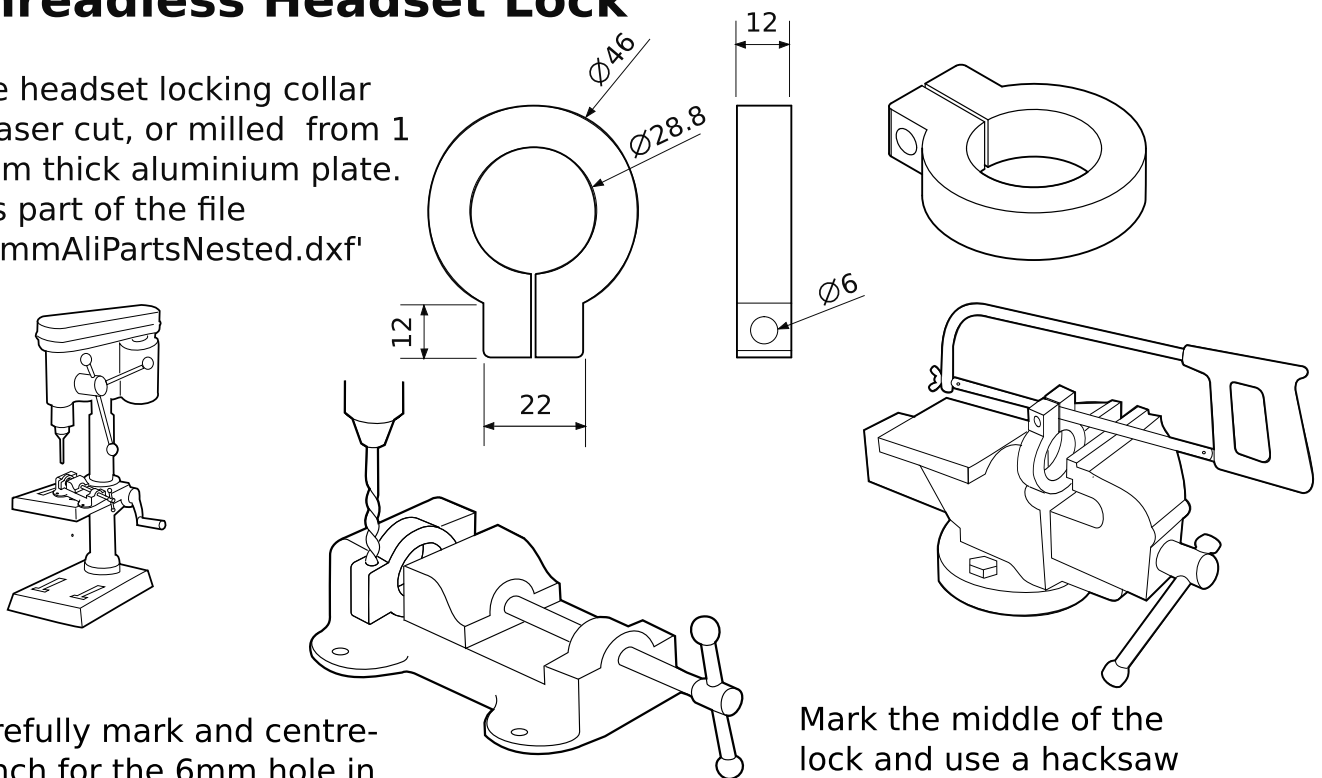
You will need:

- 1pc. crank set.
- 34 tooth Chainwheel (or similar)
- Pair pedals
- 127mm Threadless bottom bracket



Threadless Headset Lock

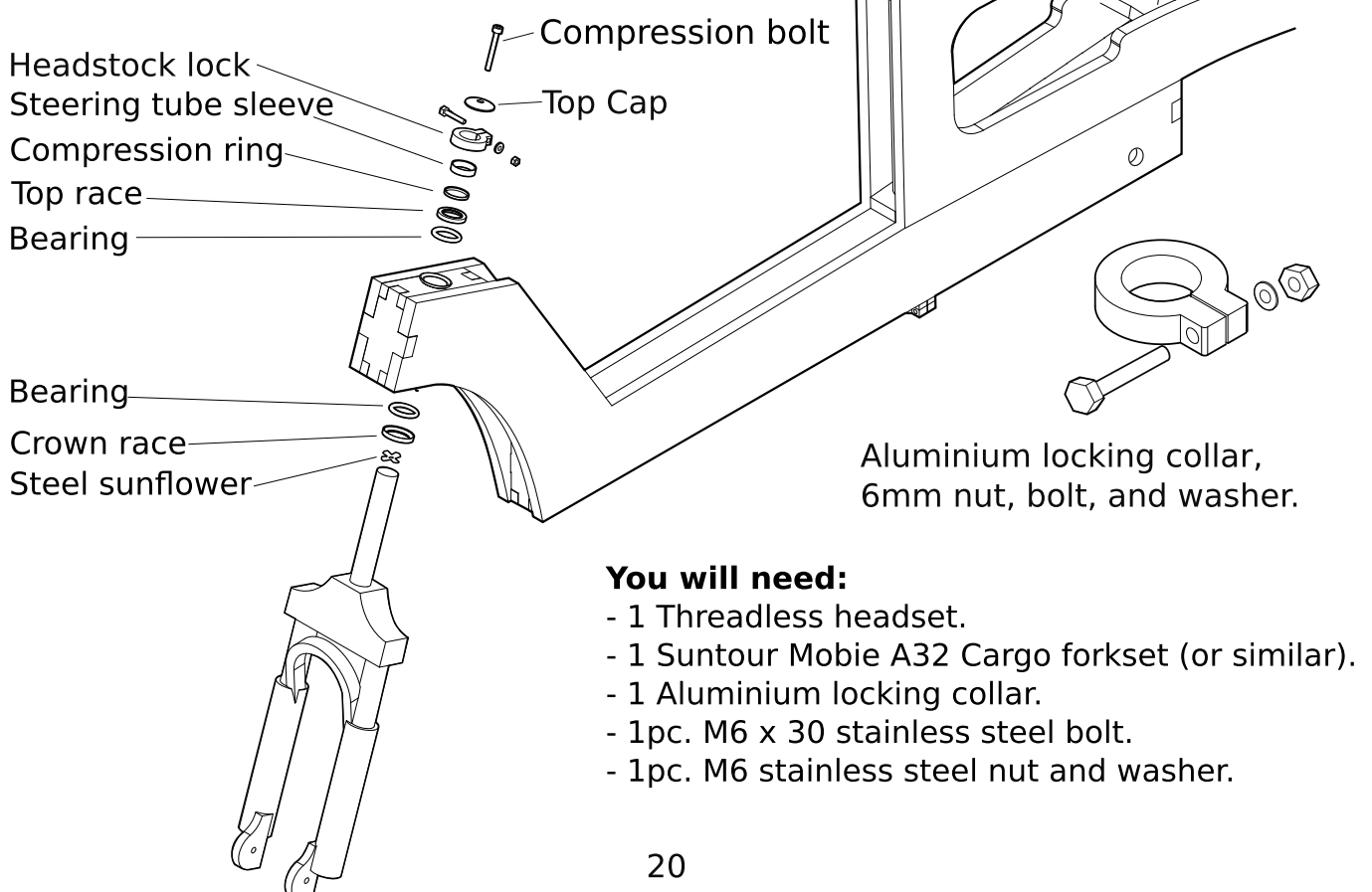
The headset locking collar is laser cut, or milled from 12mm thick aluminium plate. It is part of the file '12mmAliPartsNested.dxf'



Carefully mark and centre-punch for the 6mm hole in the middle of the flat at the back of the lock. Drill the hole, preferably with a drill press.

Mark the middle of the lock and use a hacksaw to cut a slot.

Assembling the Front Forks

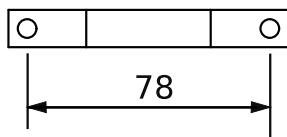
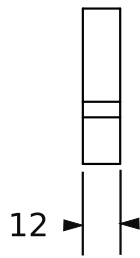
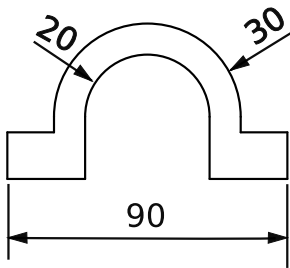


You will need:

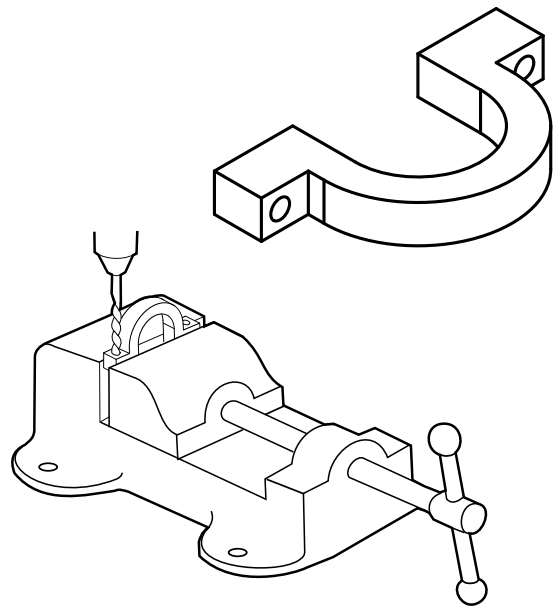
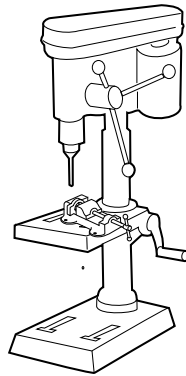
- 1 Threadless headset.
- 1 Suntour Mobie A32 Cargo forkset (or similar).
- 1 Aluminium locking collar.
- 1pc. M6 x 30 stainless steel bolt.
- 1pc. M6 stainless steel nut and washer.

Front Steering Lever Bracket

The design of this part will vary depending on the front forks you use.

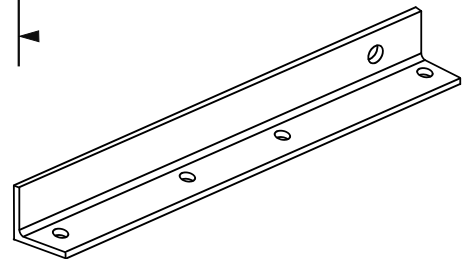
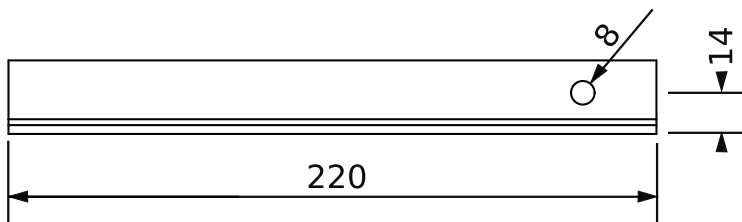
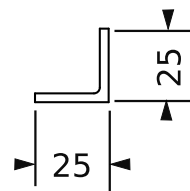
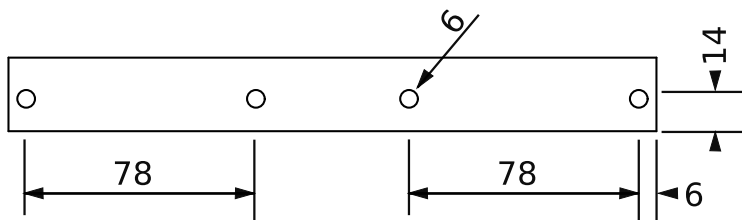


The front steering lever brackets are laser-cut or milled from the file called '12mm AliPartsNested.dxf'. They are 12mm thick aluminium plate. You will need two of them.

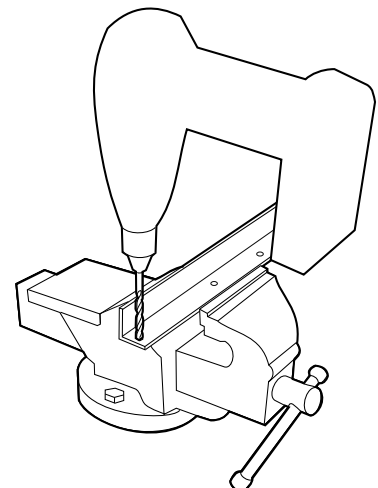


Carefully mark and centre punch for the 6mm holes in the middle of the flats. Drill the hole, preferably with a drill press.

Front Steering Lever



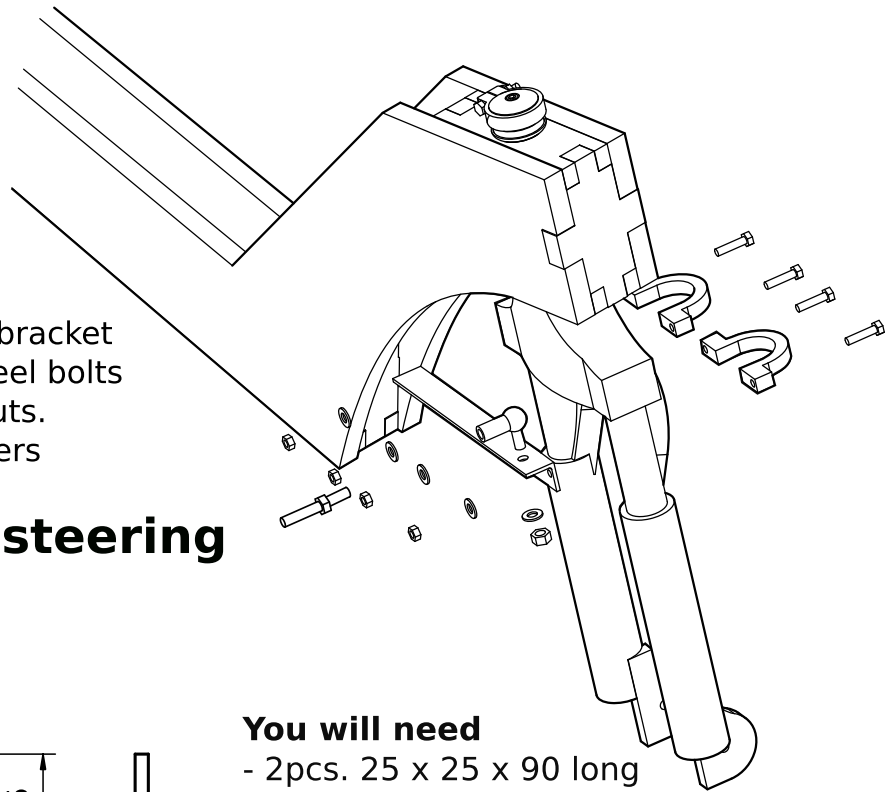
The front steering lever is made from a piece of 25mm x 25mm mild steel angle iron, 220mm long. It has four 6mm holes drilled to fix the steering lever brackets and 1 x 8mm hole for the ball joint.



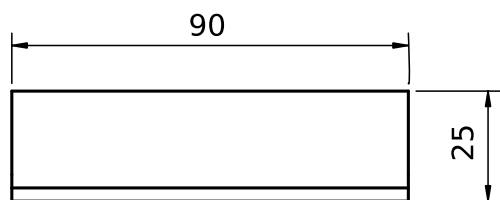
Assembling The Front Steering Lever

You will need:

- 1pc. Front steering lever
- 2pcs. Front steering lever bracket
- 4pcs. M6 x 25 stainless steel bolts
- 4pcs. M6 stainless steel nuts.
- 4pcs. stainless steel washers

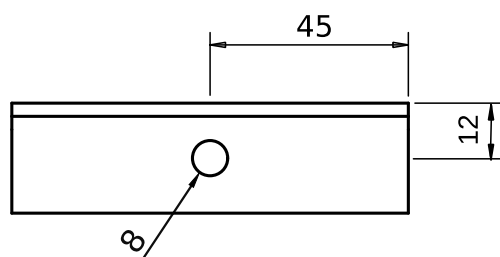


Assembling the steering connection bar

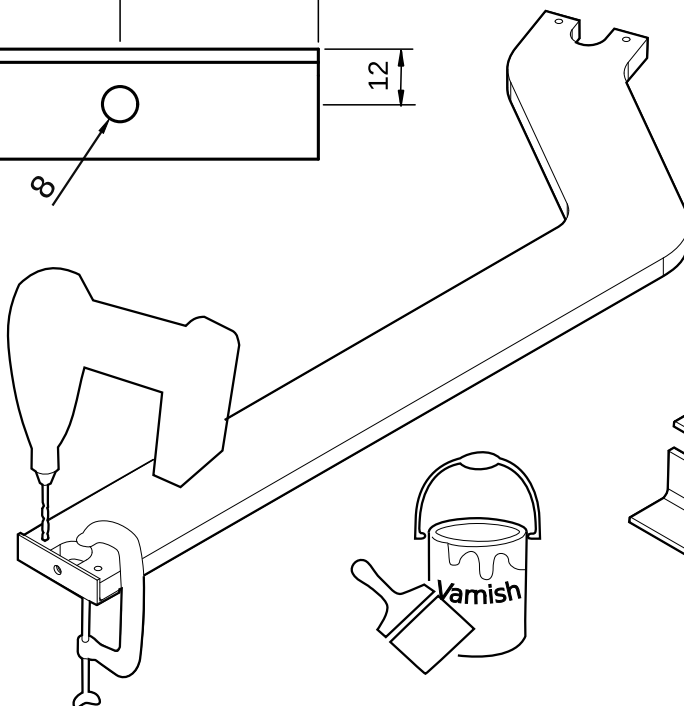
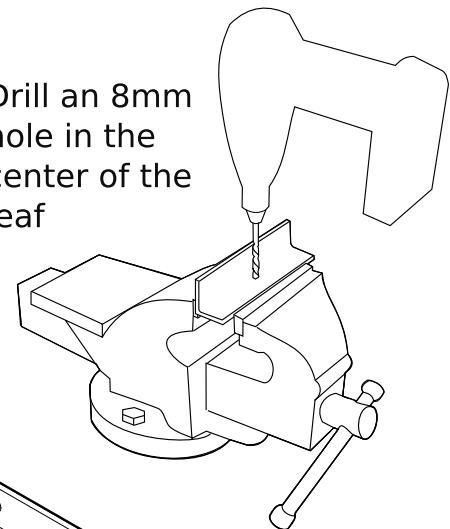


You will need

- 2pcs. 25 x 25 x 90 long m/s angle iron, drilled to take the ball-joint



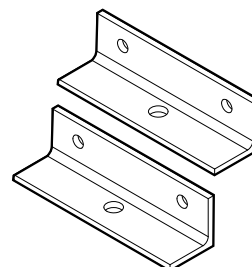
Drill an 8mm hole in the center of the leaf



Drill four 6mm holes through the plywood bar into the steel brackets, so the bolt holes match up

Sand the bar smooth and give it 3 or 4 coats of varnish

A couple of coats of metal paint will help to stop the bracket rusting

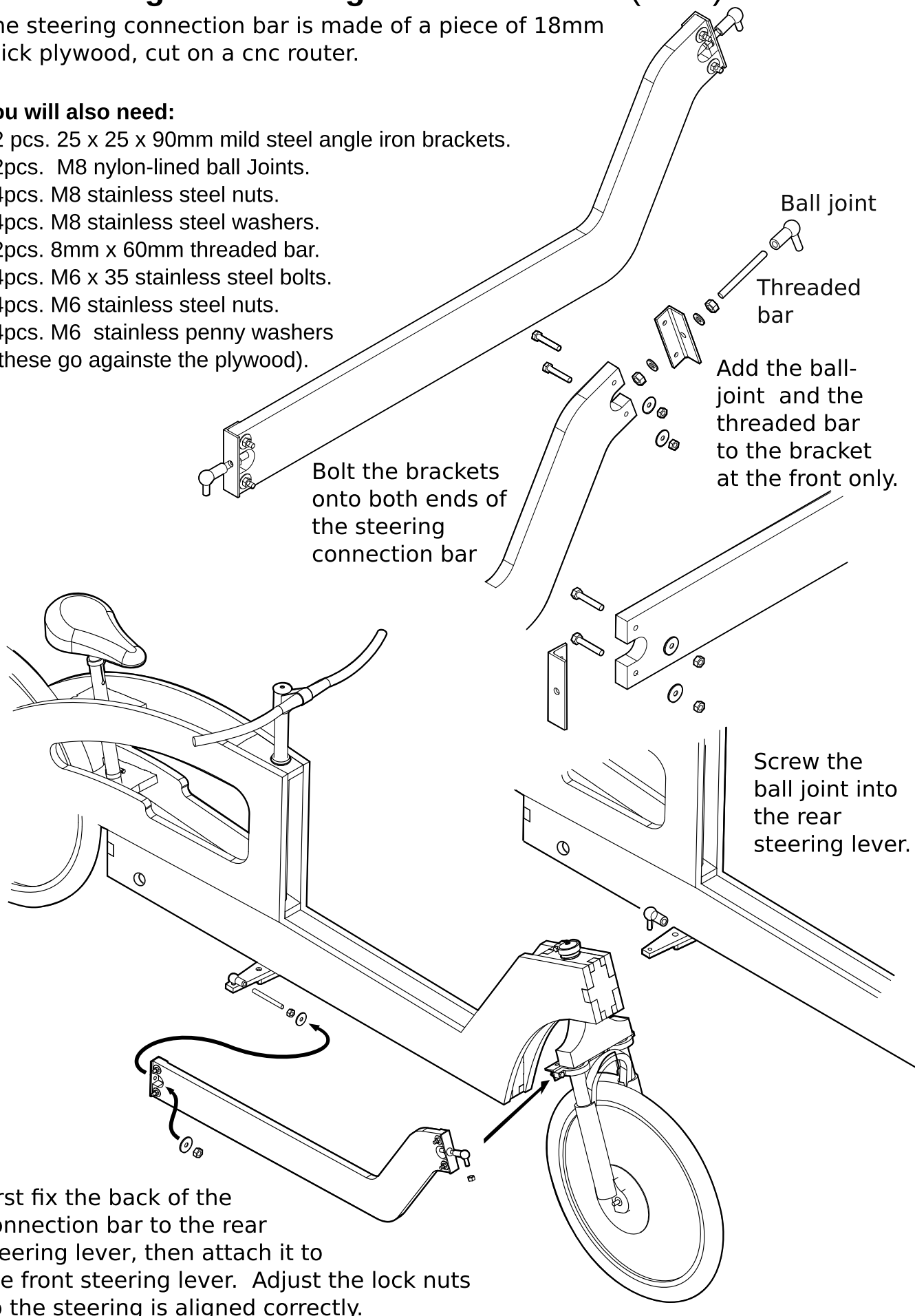


Assembling the Steering Connection Bar (cont.)

The steering connection bar is made of a piece of 18mm thick plywood, cut on a cnc router.

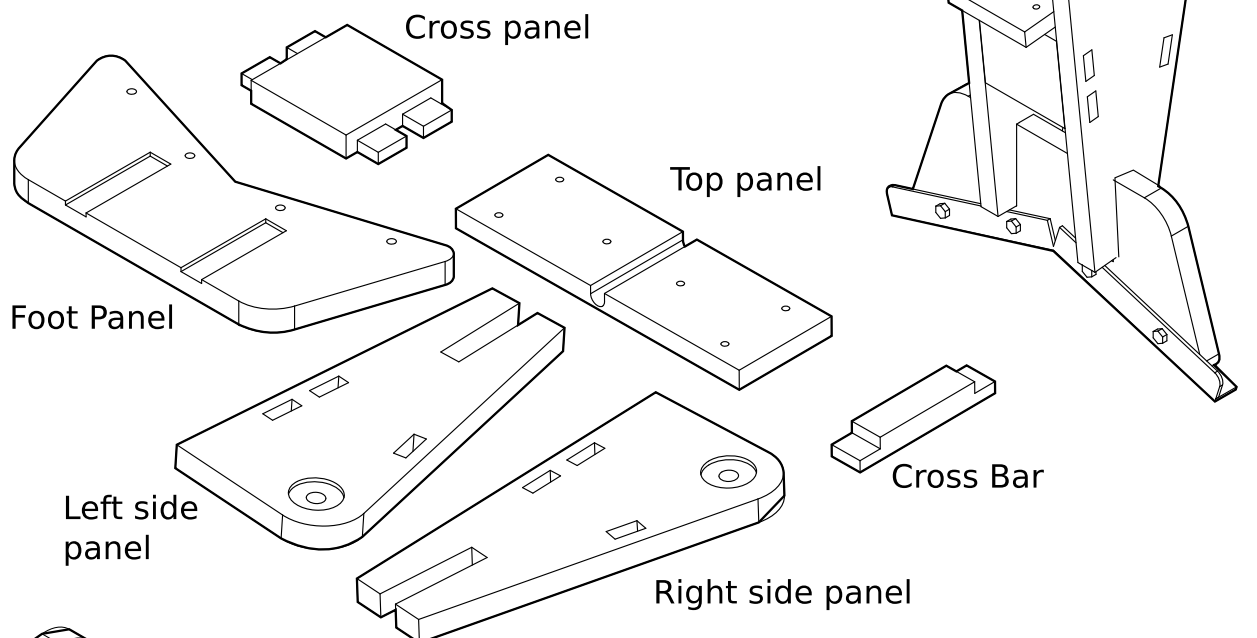
You will also need:

- 2 pcs. 25 x 25 x 90mm mild steel angle iron brackets.
- 2pcs. M8 nylon-lined ball Joints.
- 4pcs. M8 stainless steel nuts.
- 4pcs. M8 stainless steel washers.
- 2pcs. 8mm x 60mm threaded bar.
- 4pcs. M6 x 35 stainless steel bolts.
- 4pcs. M6 stainless steel nuts.
- 4pcs. M6 stainless penny washers (these go against the plywood).



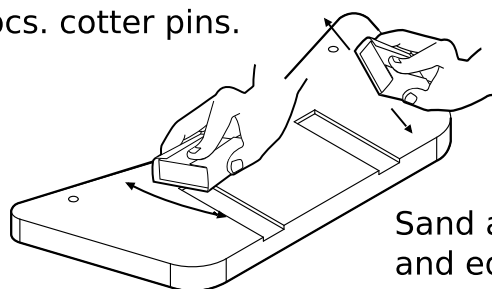
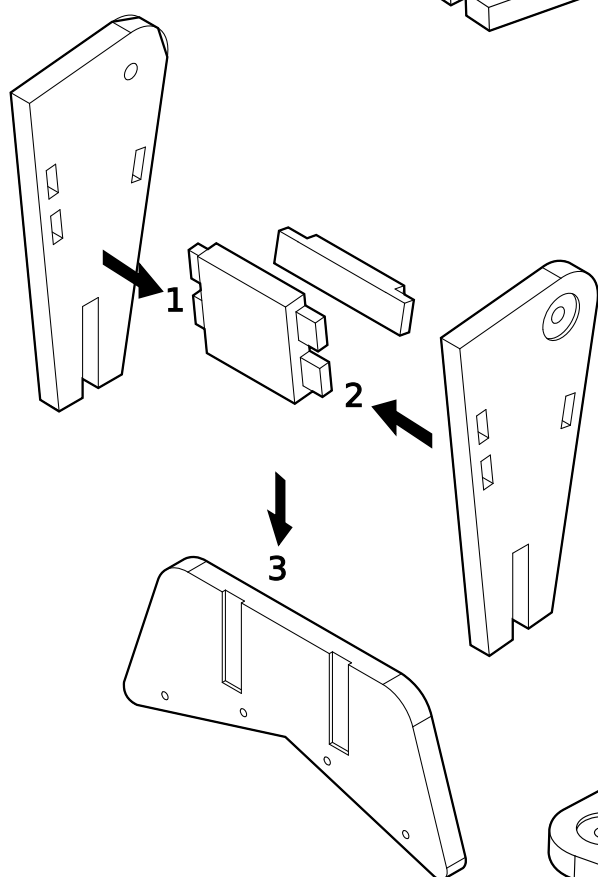
Making the Kick Stand

The kick-stand is made up of six 18mm thick plywood components

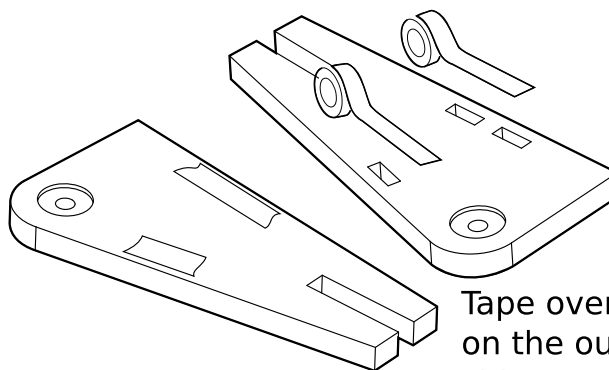


You will also need:

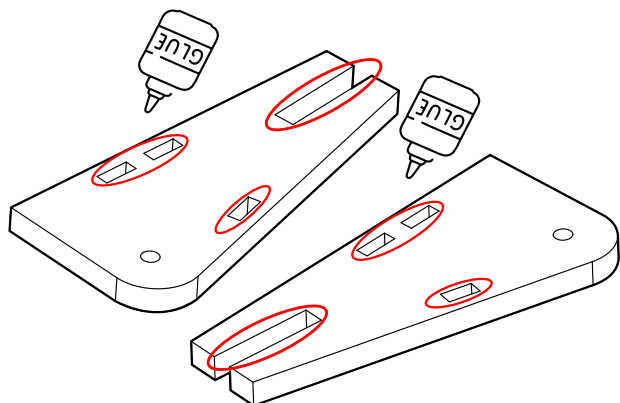
- 4pcs. M6 x 35 stainless steel bolts.
- 4pcs. M6 stainless steel nuts and washers.
- 4pcs. M6 large stainless steel washer.
- 1pc. 12mm stainless steel rod 130mm long.
- 1pc. mild steel 25 x 25mm angle iron 360mm long.
- 2pcs. cotter pins.



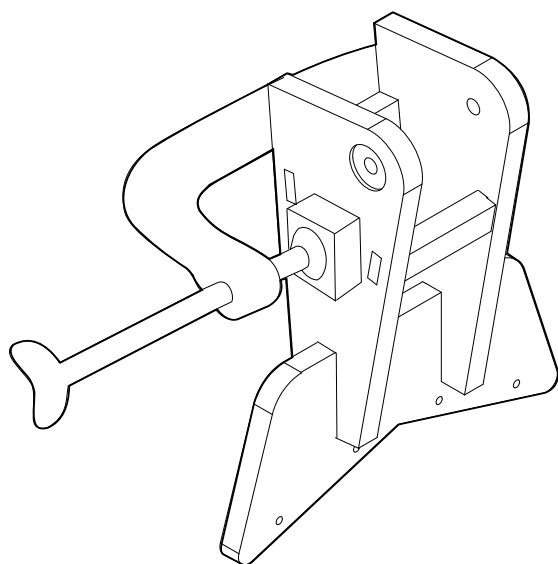
Familiarise yourself with the parts, and make sure they fit together well.



Making the Kick Stand (cont)

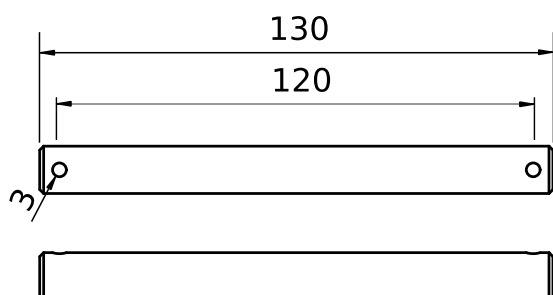


Add glue to all the joints

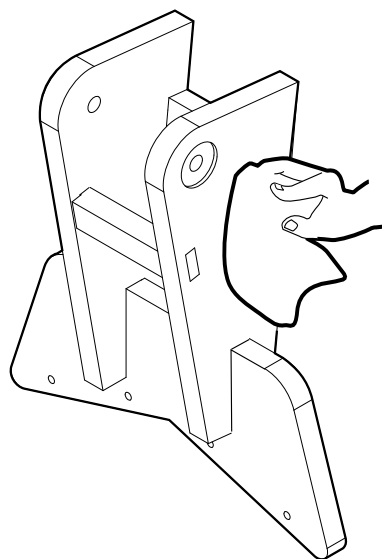
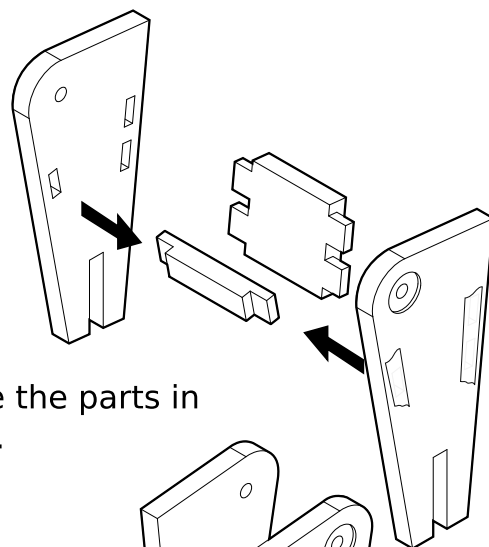


Make sure the halving joints are up tight against the stops, and use a G clamp to clamp the sides together.

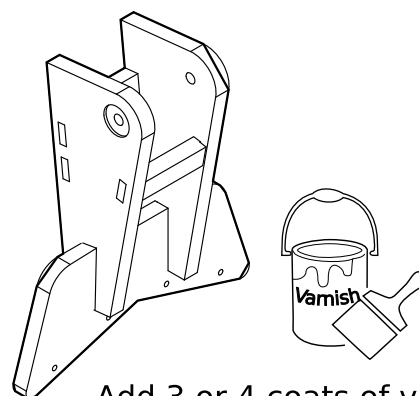
Make the pivot from one piece of 12mm dia. stainless steel rod. 130mm long with two 3mm dia. holes.



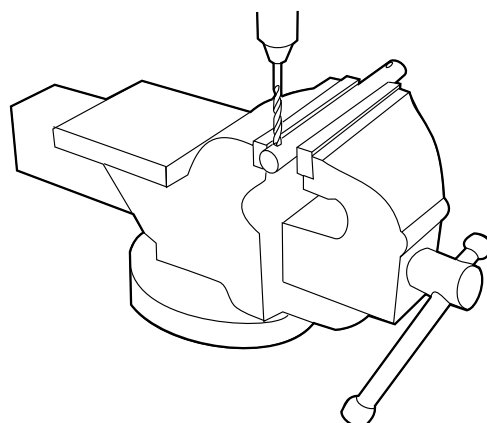
Assemble the parts in two goes.



Remove the tape and wipe away the excess glue with a damp cloth

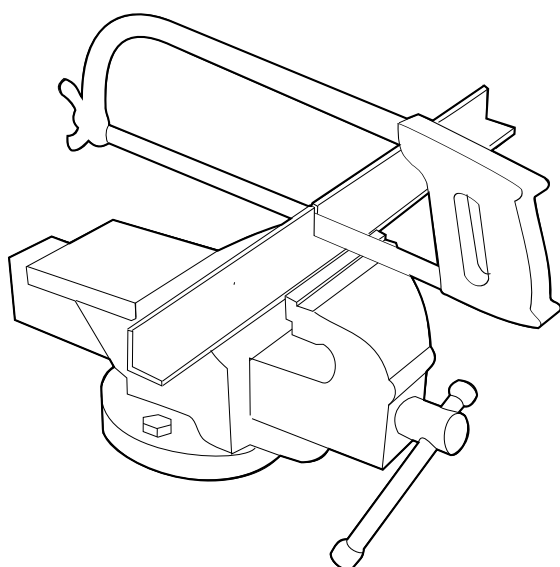
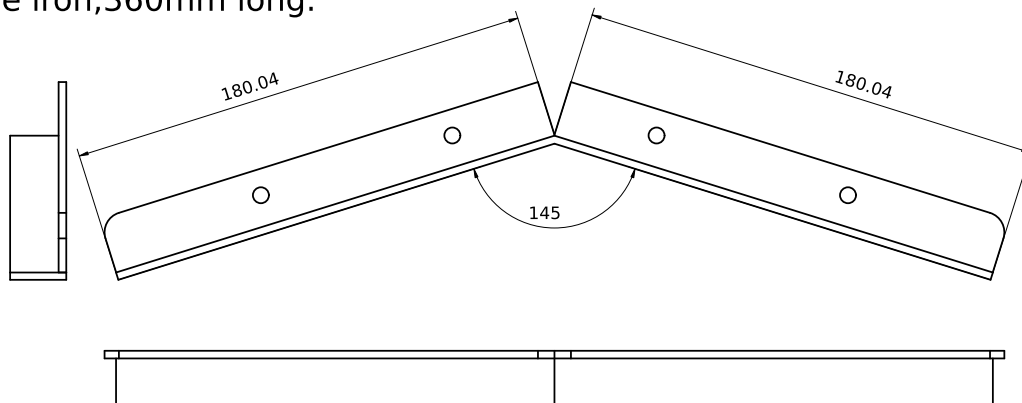


Add 3 or 4 coats of varnish.

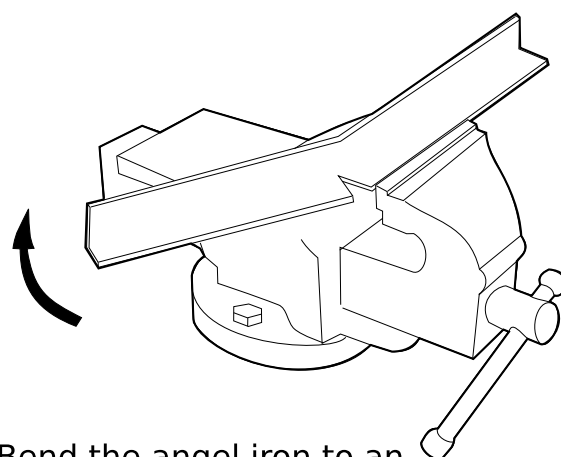


Making the Kick Stand (cont.1)

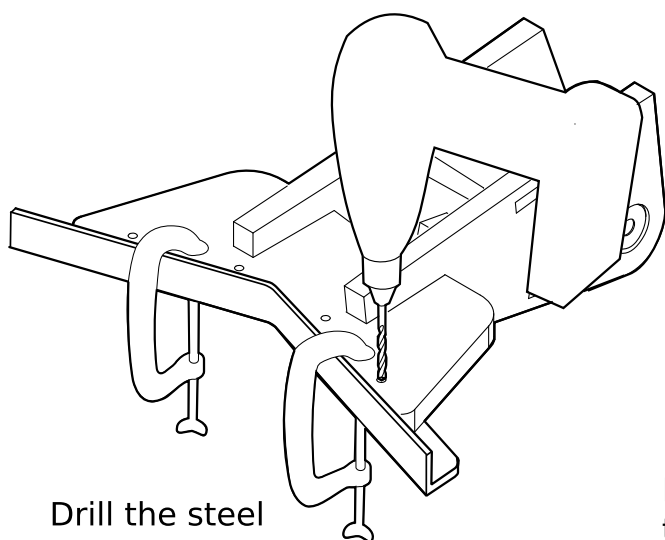
The steel foot is made from a piece of 25 x 25mm mild steel angle iron, 360mm long.



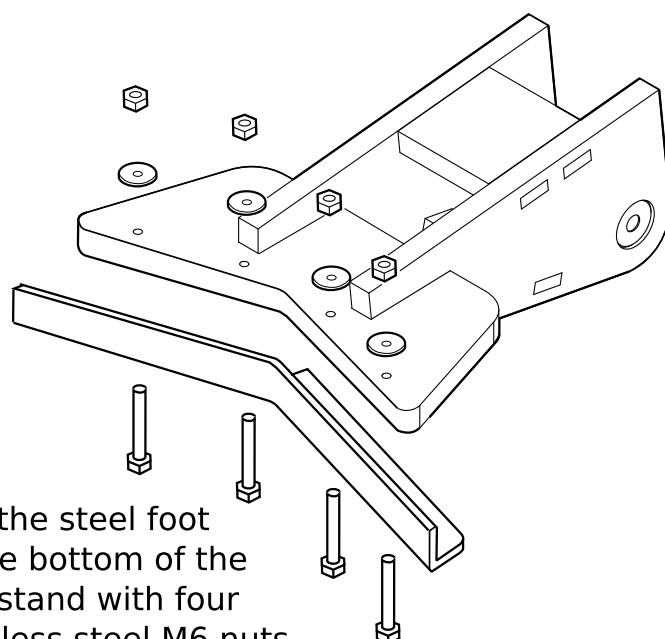
Saw down the center of one wing of the bar



Bend the angel iron to an angle of 145 degrees

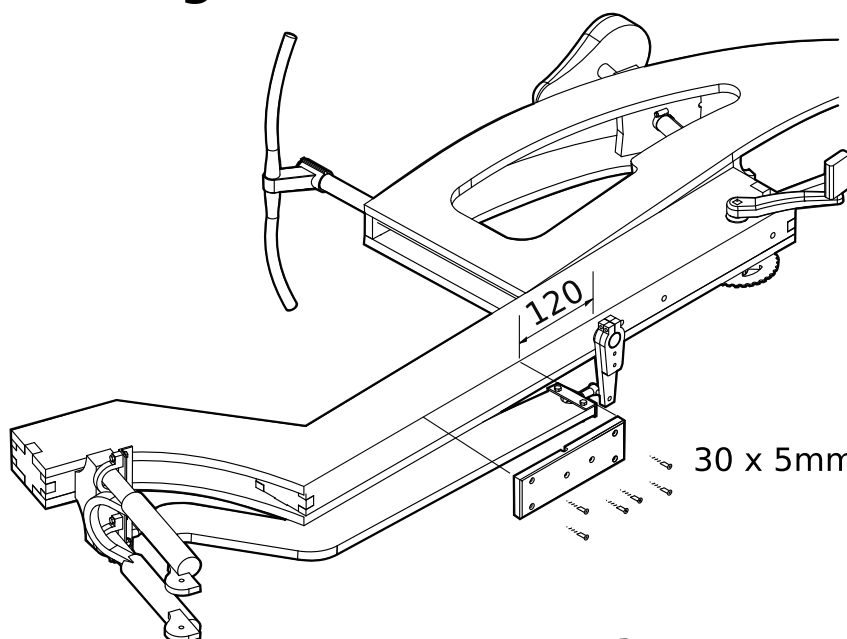


Drill the steel foot through the wooden base of the kick stand so that the bolt holes line up.



Bolt the steel foot to the bottom of the kick stand with four stainless steel M6 nuts, bolts, and large penny washers

Fixing the Kick Stand to the Frame

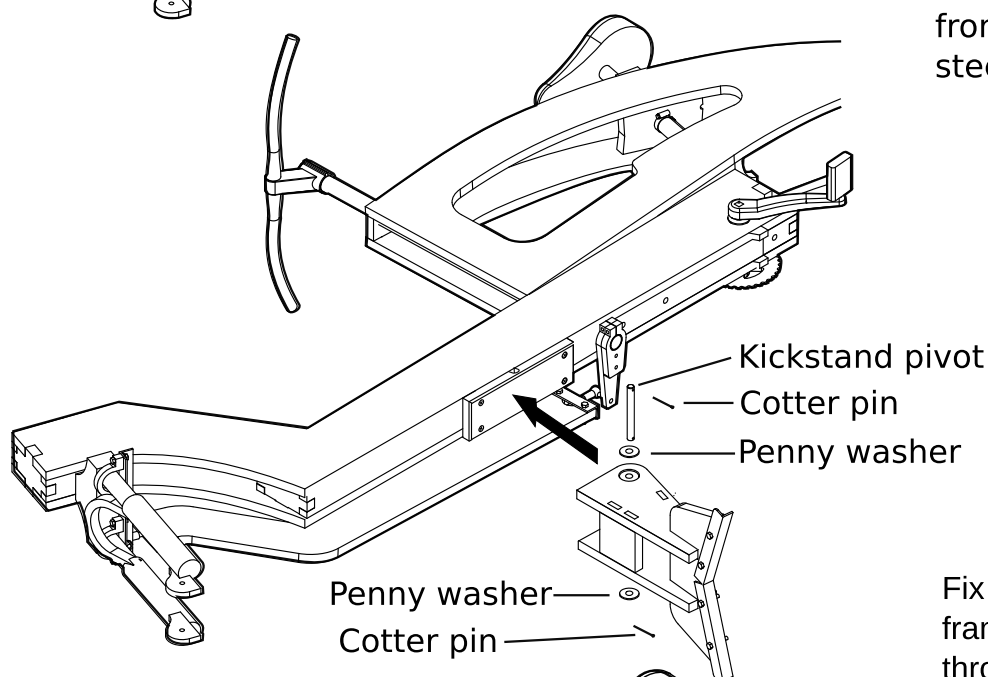


You will need

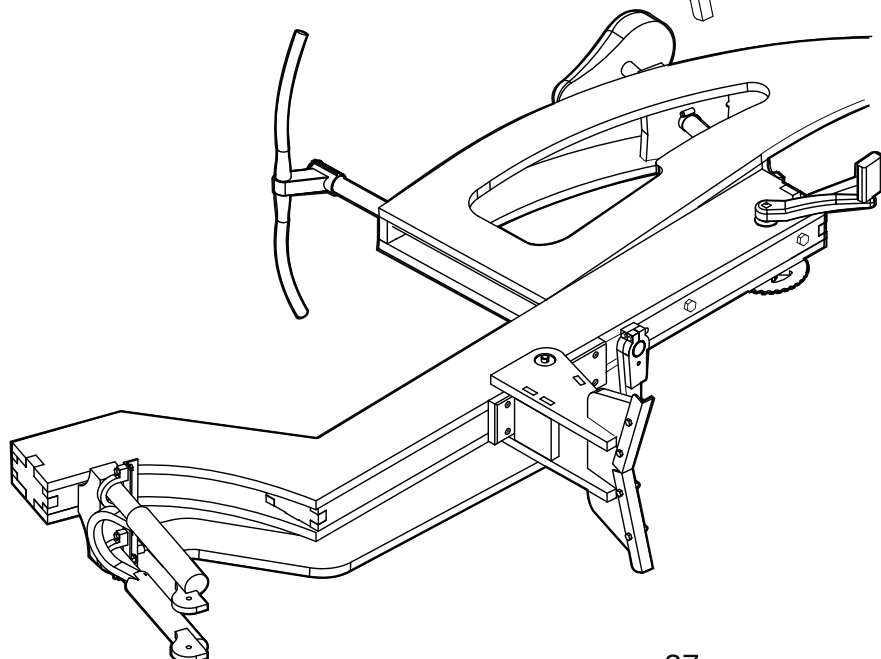
- 6 pcs. 30 x 5mm woodscrews.
- 2pcs. large stainless steel washers.
- 2pcs. 40mm cotter pins.
- 1 kick stand pivot made from 12mm dia stainless steel rod.

30 x 5mm woodscrews

Screw the kickstand top plate to the bottom of the front frame, 120mm from the center of the steerer tube.



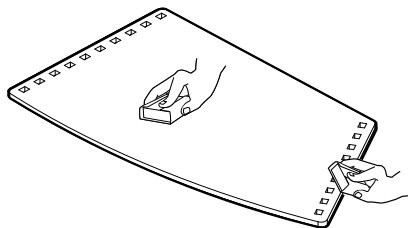
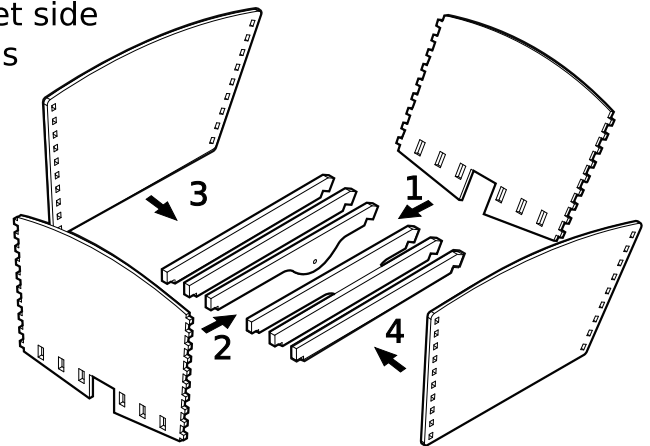
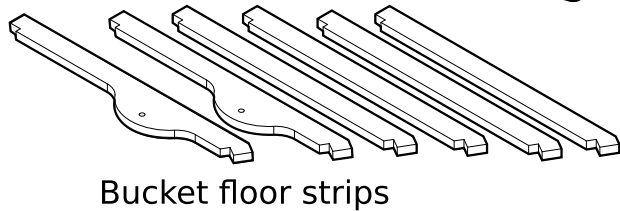
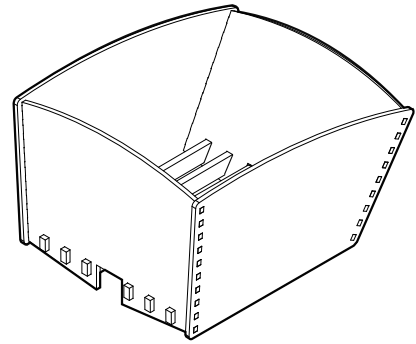
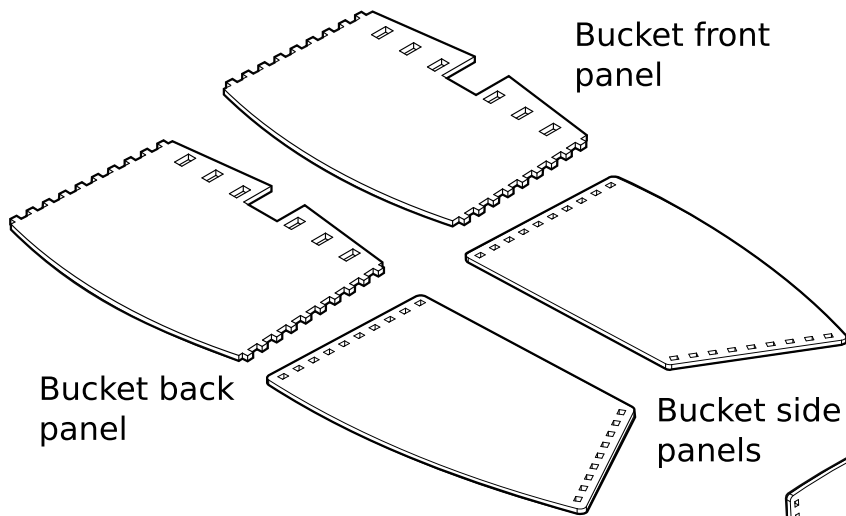
Fix the kickstand to the front frame by passing the pivot through the holes in the kickstand and the top plate. Add washes to both sides, and secure the pivot with the cotter pins.



Use a length of inner tube as a spring to hold the kickstand up.

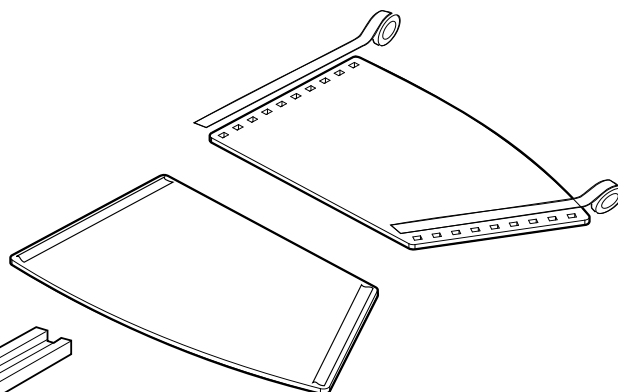
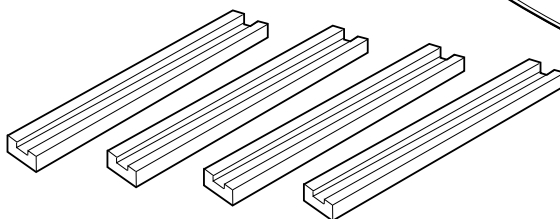
Assembling the Front Bucket

The front Bucket is made up of six 18mm thick floor components, and four 12mm thick side components, all cut using a cnc router.



Round off all the arras edges that do not coincide with another part. This could be done with sandpaper, or use a router and a 4mm rounding over cutter.

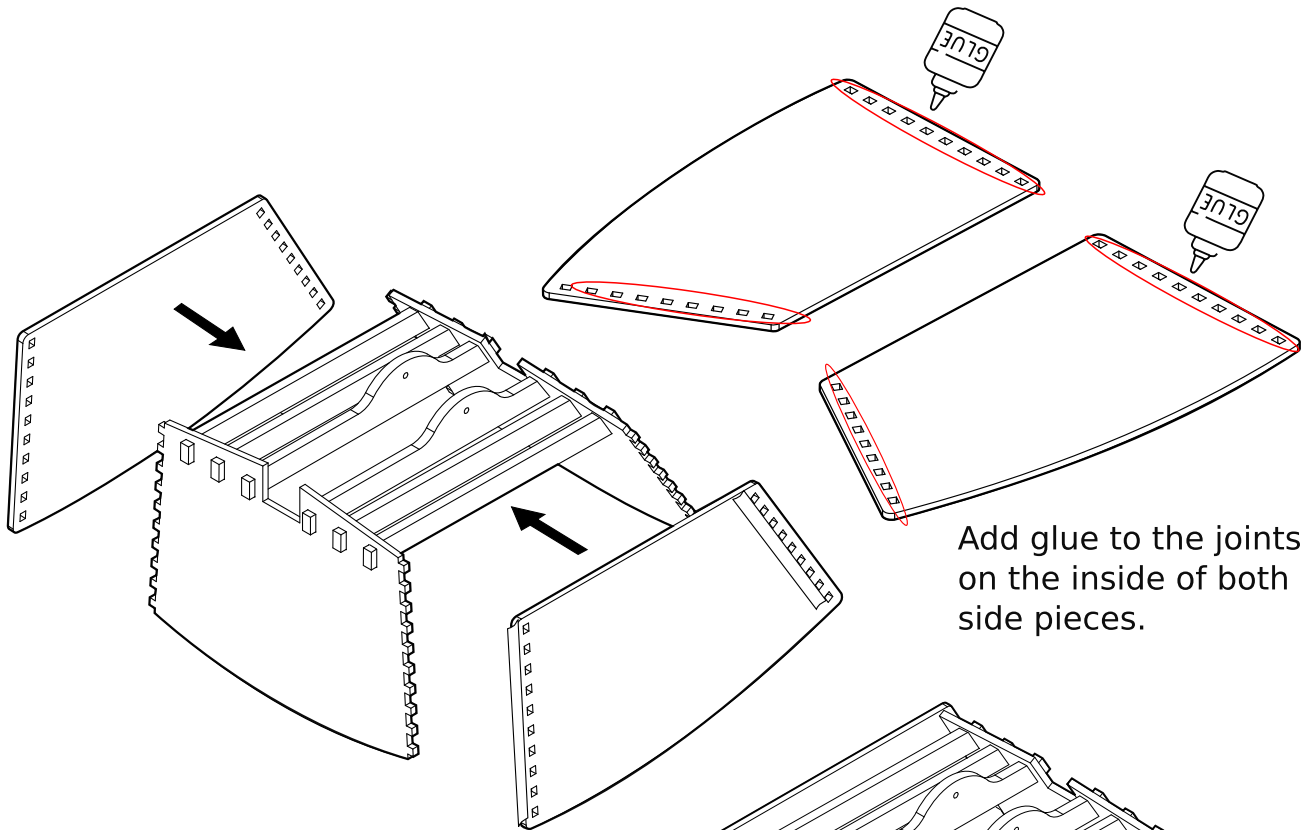
Familiarise yourself with all the parts and how they fit together to form the structure.



Use masking tape to cover one side of the joints so the glue does not drip out.

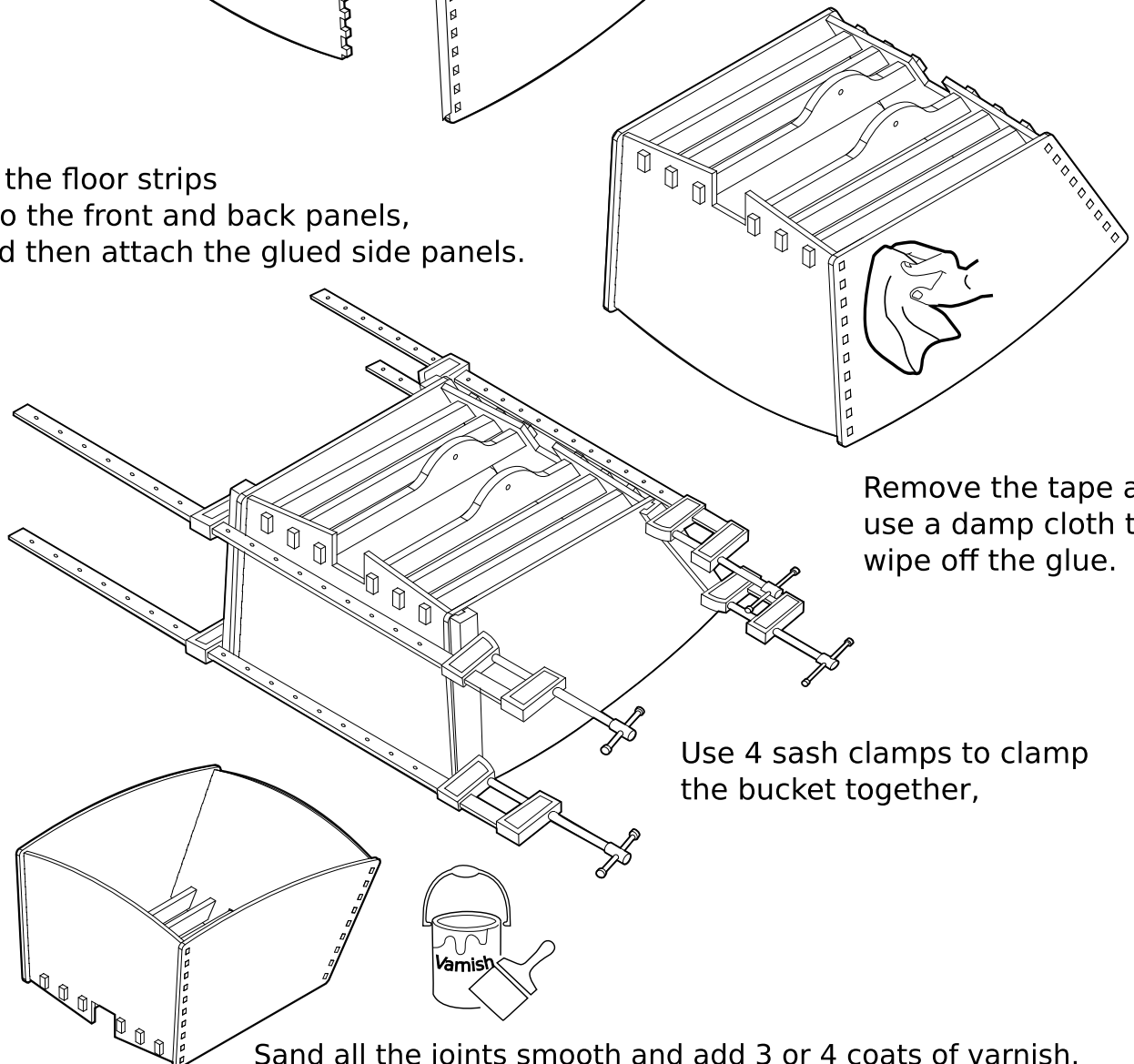
Prepare four pieces of scrap timber with 12mm grooves, to protect the box from the sash clamps.

Assembling the Front Bucket (cont.)



Add glue to the joints on the inside of both side pieces.

Fit the floor strips into the front and back panels, and then attach the glued side panels.

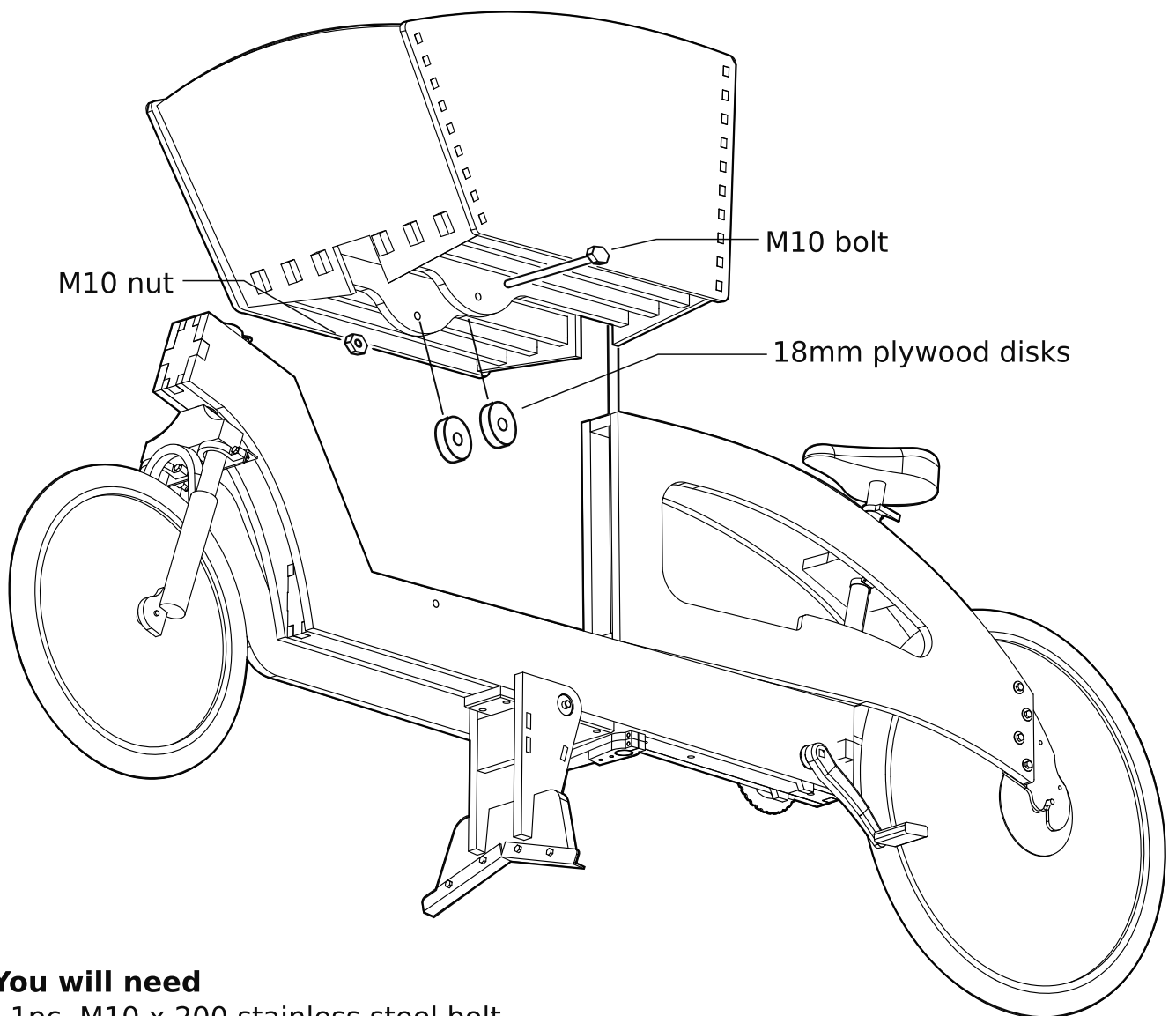


Remove the tape and use a damp cloth to wipe off the glue.

Use 4 sash clamps to clamp the bucket together,

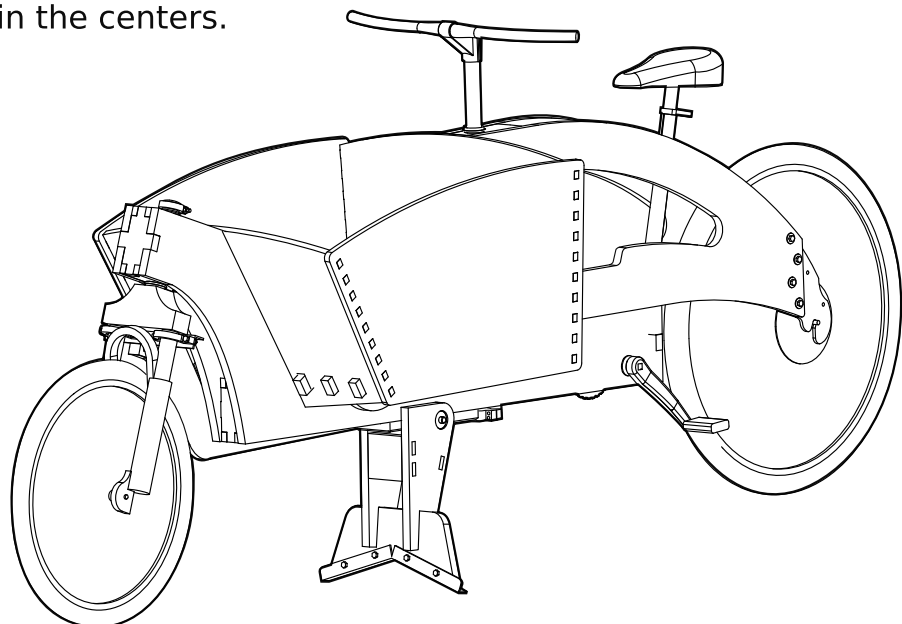
Sand all the joints smooth and add 3 or 4 coats of varnish.

Fixing the Bucket to the Frame



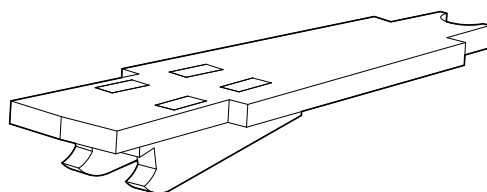
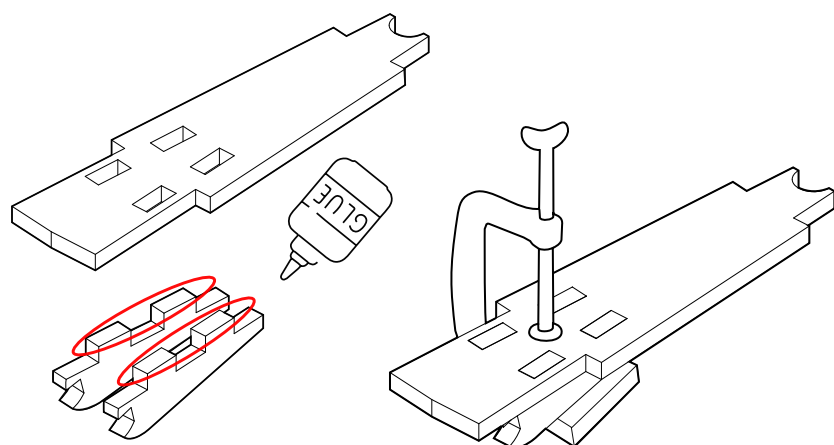
You will need

- 1pc. M10 x 200 stainless steel bolt
- 1pc. M10 stainless steel nut
- 2pcs. 18mm thick plywood disks with 10mm holes in the centers.

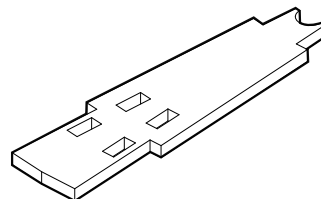


Making the Battery Panel

The battery panel is made up of the top board, and two side pieces, all cut from 18mm plywood.

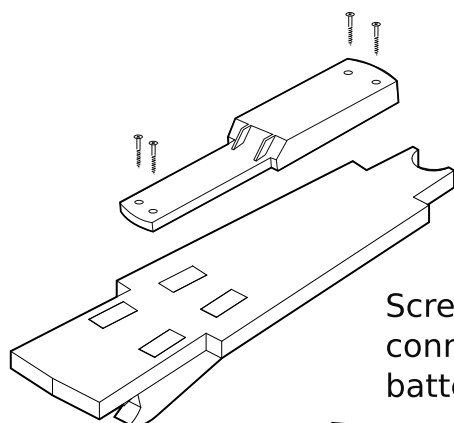


Battery panel top



Battery panel sides

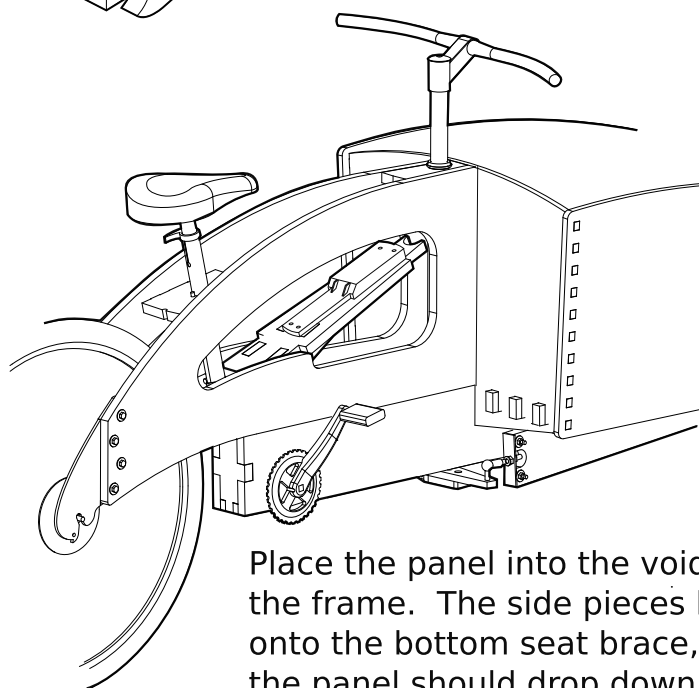
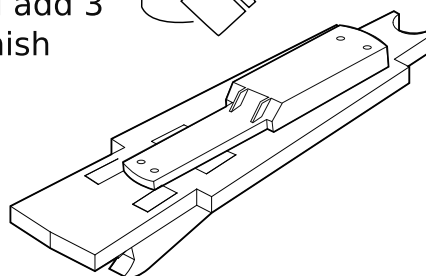
Glue and clamp the two side pieces into the top board, using some scrap timber to protect the panel.



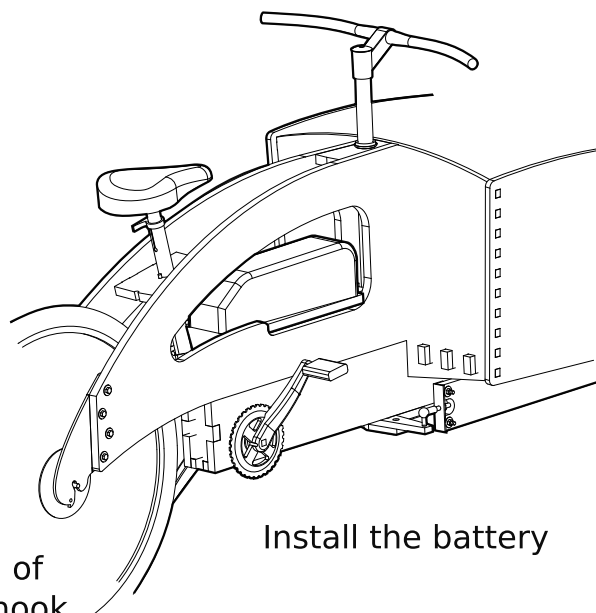
Sand all over and add 3 or 4 coats of varnish



Screw the battery connection block to the battery panel.

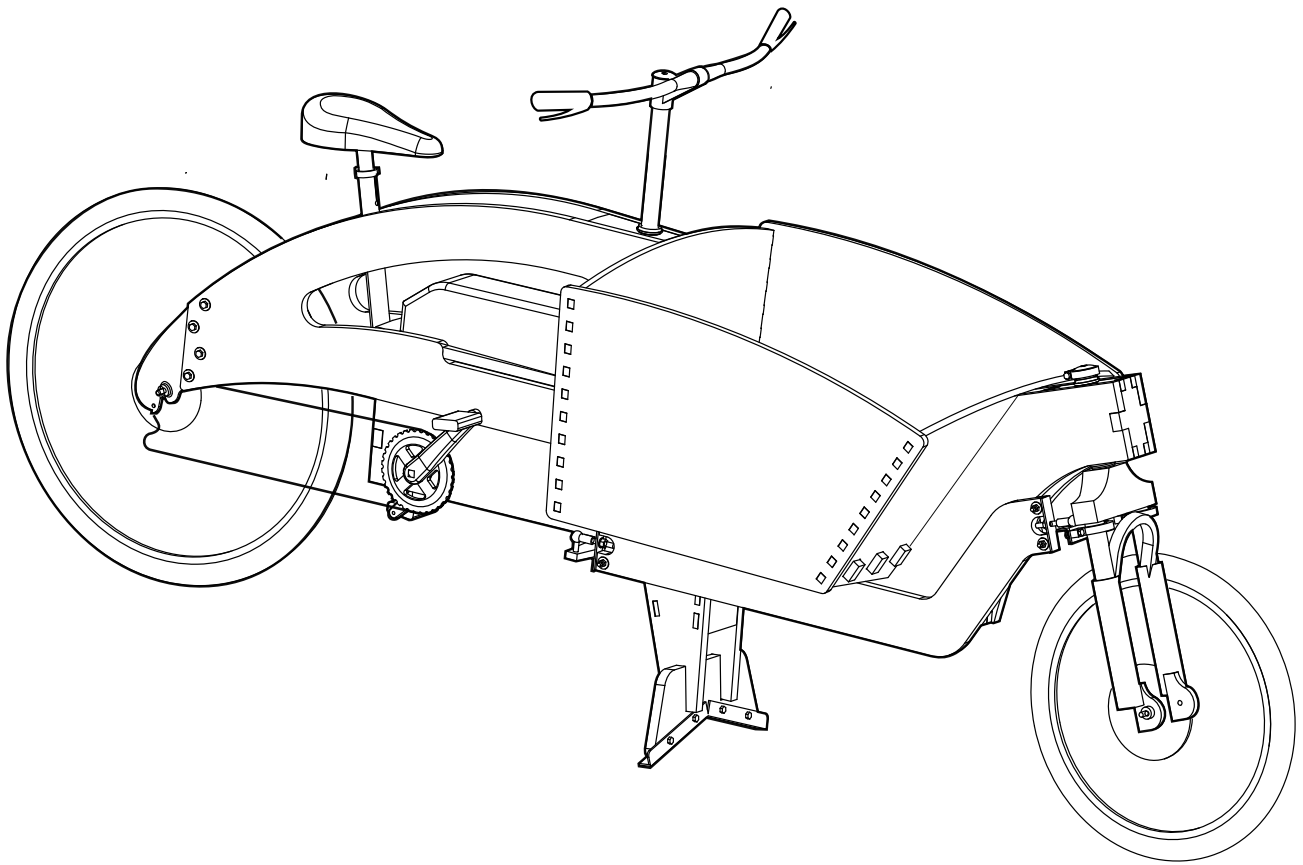


Place the panel into the void of the frame. The side pieces hook onto the bottom seat brace, and then the panel should drop down into the frame.



Install the battery

Wheels, Brakes, Gears, Grips, and Electrics



Now it is time to add wheels, brakes, gears, grips, and electrics. However, these activities are beyond the scope of this manual. If you don't already know how to install these components, there are many books, YouTube videos, and forums that explain these processes far better than I can. But if you have made it this far, the rest is simple.

Finally, if you build one of these, please let me know—send me photos, comments, and ideas for improvements. Likewise, if you run into difficulties, please get in touch.

Aaron Moore

April 2026

aaron@cnccraft.co.uk

Let's make it local

Bill of Materials

1 Sheet 18mm Marine plywood. All parts listed below are cut on a CNC Router.
Use file "18mmPlywoodPartsNested.dxf"

- 1pc. Front frame top panel
- 1pc. Front frame bottom panel
- 1pc. Front frame left side
- 1pc. Front frame right side
- 1pc. Front frame bottom front end panel
- 1pc. Front frame bottom rear end panel
- 2pcs. Front frame top front end panels (these are slightly different)
- 2pcs. Front frame top and bottom front panels
- 1pc. Rear frame top panel
- 1pc. Rear frame bottom panel
- 1pc. Rear frame left side
- 1pc. Rear frame right side
- 1pc. Seat stay top
- 1pc. Seat stay bottom
- 1pc. Kick stand left side
- 1pc. Kick stand right side
- 1pc. Kick stand foot panel
- 1pc. Kick stand front panel
- 1pc. Kick stand cross bar
- 1pc. Steering connection bar
- 4pcs. Front bucket floor strips (straight)
- 2pcs. Front bucket floor strips (with holes)
- 1pc. Battery plate top panel
- 2pcs. Battery plate sides (identical)

1 sheet 12mm Marine plywood. All parts listed below are cut on a CNC Router
Use file "12mmPlywoodPartsNested.dxf"

- 1pc. Front bucket back panel
- 1pc. Front bucket front panel
- 2pcs. Front bucket side panels (identicle)

12mm Aluminium plate

1pc. 300mm x 100mm - From which is cut: Mid steering lever, Front steering lever brackets and Threadless headstock collar. Use file '12mmAliPartsNested.dxf'

6mm Aluminium plate

1pc. 300mm x 250mm - From which is cut: Gear side dropout, and break side.
Use file '6mmAliDropOutsNested.dxf'

Stainless steel tube

- 1pc. 28.8mm dia x 1.5mm wall x 300mm long - Seat stay
- 1pc. 28.8mm dia x 1.5mm wall x 680mm long - Mid steering tube
- 1pc. 31mm dia. x 1.5mm wall x 5mm long - Front steering tube sleeve.
- 1pc. 31mm dia. x 1.5mm wall x 50mm long - Mid steering tube sleeve top.
- 1pc. 31mm dia. x 1.5mm wall x 135mm long - Mid steering tube sleeve bottom.

Bill of Materials (cont.)

Mild steel bike tubing (sourced from specialist bike frame building company).

1pc. 37mm dia. x 1.5mm wall x140mm long - Head stock tube.

1pc. 37mm dia. x 1.5mm wall x380mm long - Mid steering bearing tube.

Stainless steel rod

1pc, 6mm dia. x 220mm - Seat stay locator rod.

1pc. 12mm dia. x 130mm - Kick stand pivot.

Mild steel threaded rod

1pc. M12 x 800mm long + nuts and penny washers - used for press fitting the bearing cups.

Stainless Steel nuts, bolts, and washers

3pcs. M10 x 180 bolts and nuts + 6 penny washers - Front and rear frames.

8pcs. M6 x 35 bolts, nut, penny washers, and 8 small washers - Rear dropouts.

2pcs. M6 x 40 bolts, nuts, and washers- Clamping mid steering lever.

1pc. M6 x 40 bolt, nut, and washer - Clamping front headstock collar.

4pcs. M6 x 25 bolts, nuts, and washers- Front steering lever brackets.

4pcs. M6 x 35 bolts, nuts, and penny washers - Steering connection bar brackets.

2pcs. M8 nuts and washers - Securing ball joints.

4pcs. M6 x 35 bolts, nuts bolts, and penny washers - Kick stand steel foot.

2pcs. M12 penny washer - Kick stand pivot.

2pcs M6 x 20 Stainless steel countersunk cap head bolts - Connecting mid steering lever.

2pcs. M6 stainless steel nuts and washers - Connecting the mid steering lever.

Miscellaneous

2pcs. M8 Nylon-lined ball joints - Steering connection bar.

2pcs. 40mm cotter pin - Kick stand.

2pcs. 30mm jubilee clips - Seat stay.

Bicycle components

Seat and seat post 24.6mm dia.

Seat clamp 24.6mm dia.

Threadless headset 1. 1/8" dia.

Threadless bottom bracket 127mm

Front forks: suggested product - Suntour Mobie A32 Cargo forkset (or similar).

20" front wheel, tyre, and inner tube.

26" rear wheel, tyre, and inner tube with 36 volt hub motor with a compatible controller, display, brake set with sensor, and speed sensor, suggested make; Bafang.

Down tube battery, compatible with motor.

Set of pedals.

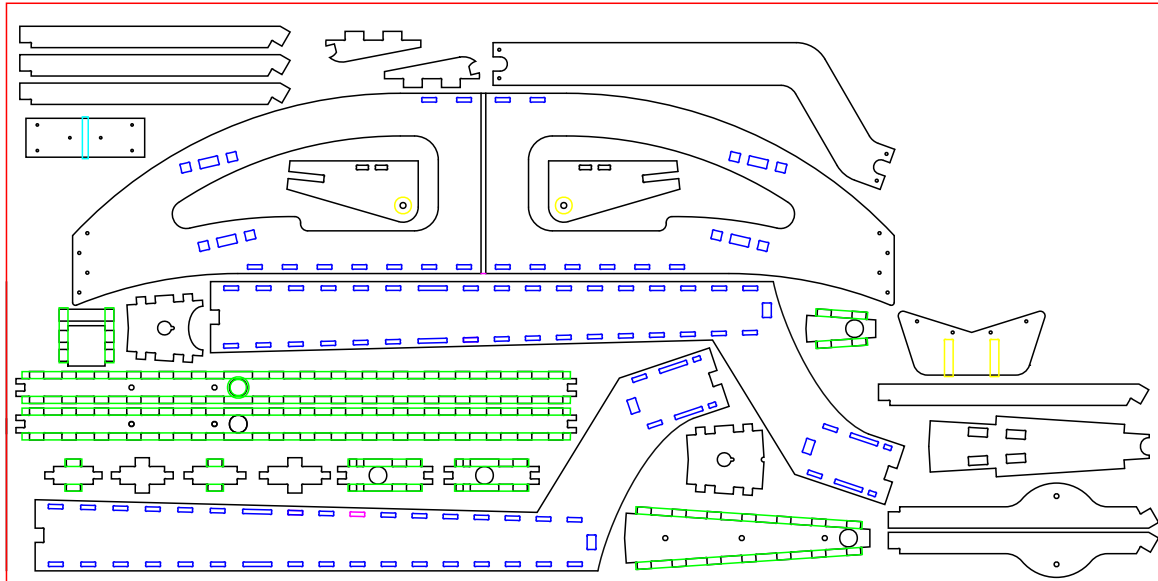
Bill of Materials (cont. 1)

Handlebars,
Handlebar stem
Mechanical disk brakes and rotors
7 Speed Derailier
7 Speed cassette
7 Speed shifter

Tools and consumables required

Access to a large format CNC router.
Large metal work vice.
Metal work files.
Hack saw.
Drill press and assorted drills.
At least 6 large G clamps and or sash clamps.
Wood work jack plane or block plane.
Wood work chisels.
Orbital sander and sandpaper.
Water-resistant adhesive.
Yacht varnish, thinners, and brushes.
Metal paint.

Images of Cutting Files (not to scale)



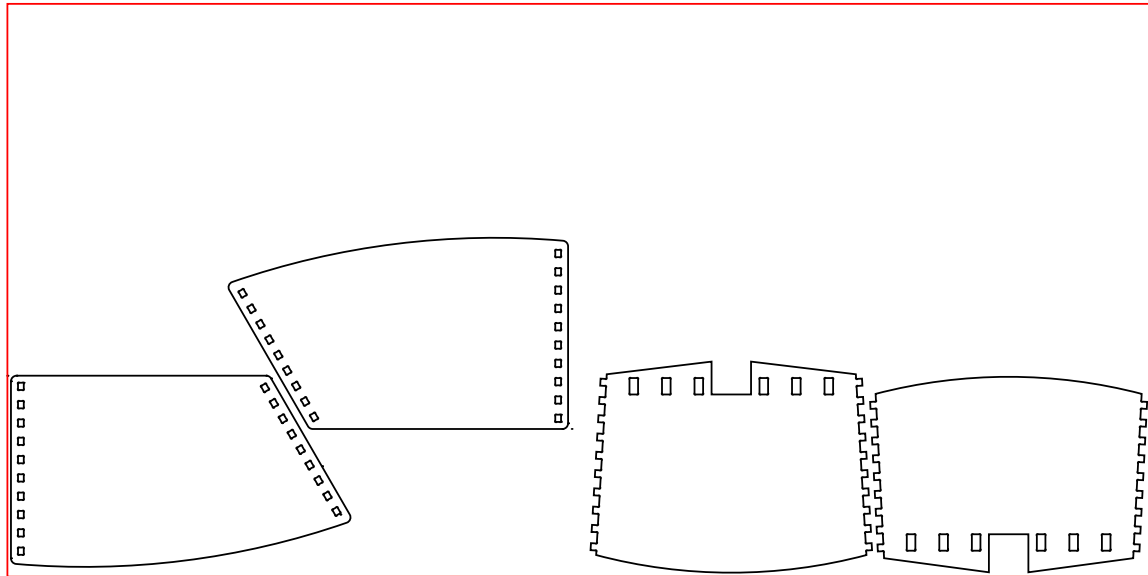
18mm marine plywood Components.

Use file '18mmPlywoodPartsNested.dxf'

Notes

- Use a 4mm x 18mm Router cutter
- Make sure the board is flat on the bed.
- Use tabs to protect the parts and the cutter

Black - cut through.
Green - 9mm pocket
Blue - 15.5mm pocket
Yellow - 3mm pocket
Light - 12mm pocket
Red - plate



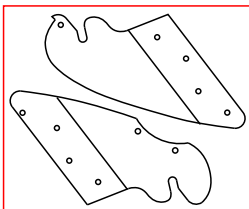
12mm marine plywood components.

Use file '12mmPlywoodPartsNested.dxf'

Notes

- Use a 4mm x 18mm Router cutter
- Use tabs to protect the parts and the cutter

Black - cut through.
Red - plate

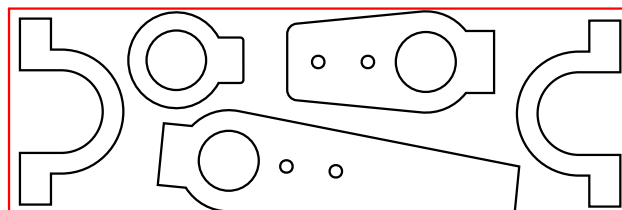


Rear Dropout Plates

Use file '6mmAlidropoutsNested.dxf'

Notes

- Use 6mm thick aluminium plate.
- Can be milled on CNC router or cut with a laser cutter.



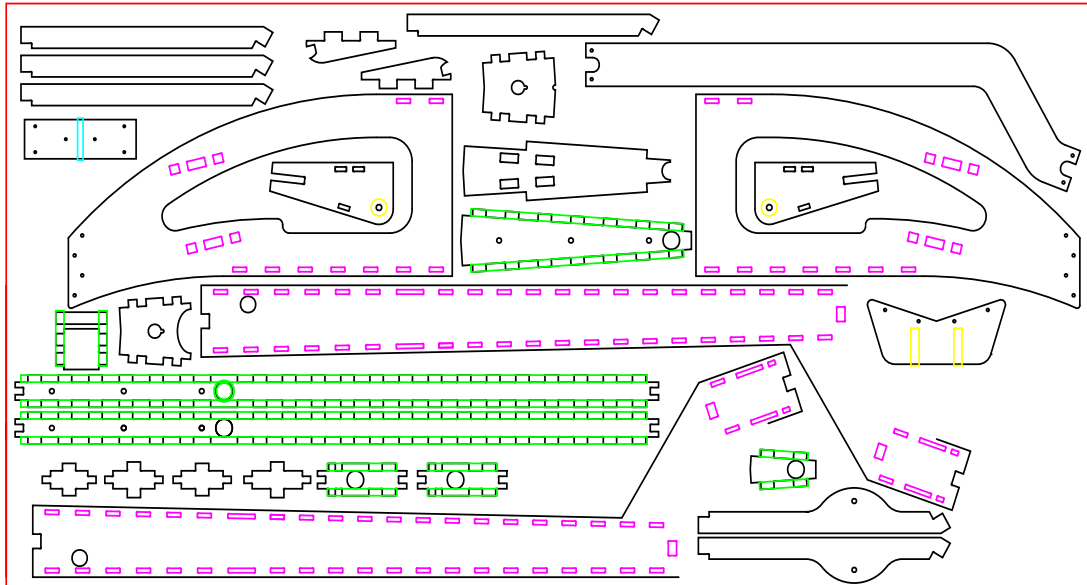
Bottom Bracket Plate

Use file '12mmAlipartsNested.dxf'

Notes

- Use 12mm thick aluminium plate.
- Can be milled on CNC router or cut on a laser cutter.

Images of Cutting Files Long John Long (no scale)

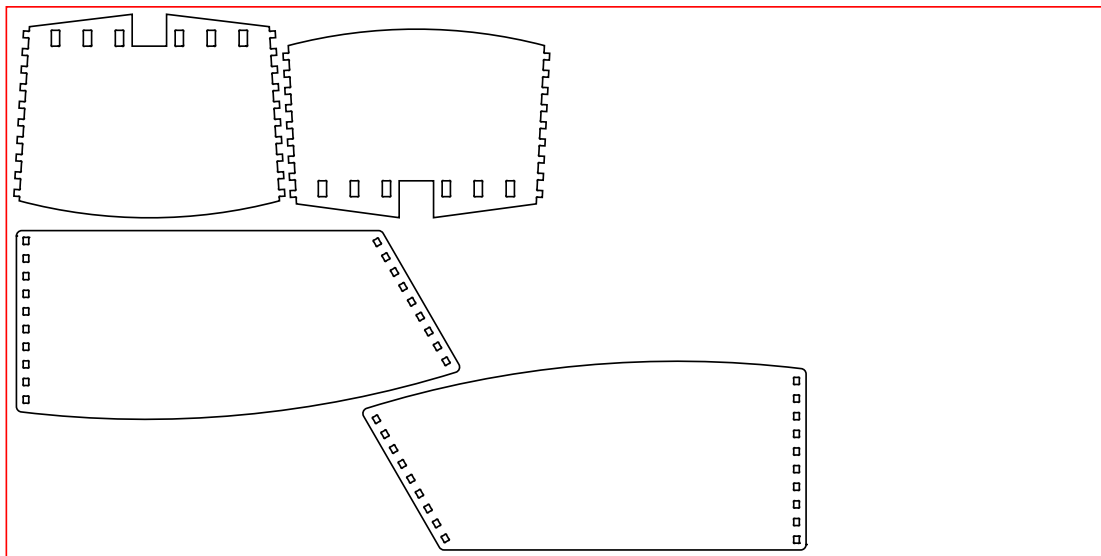


18mm marine plywood Components for Long john Long . Use file 'LongJohnLon18mmPlywoodPartsNested.dxf'

Notes

- Use a 4mm x 18mm Router cutter
- Make sure the board is flat on the bed.
- Use tabs to protect the parts and the cutter

Black - cut through.
Green - 9mm pocket
Blue - 15.5mm pocket
Yellow - 3mm pocket
Light - 12mm pocket
Red - plate

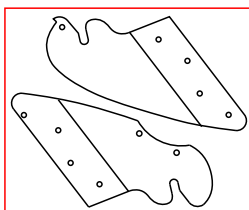


12mm marine plywwod components for Long John Short Use file ' LongJohnShort12mmPlywoodPartsNested.dxf'

Notes

- use 4mm x 18mm Router cutter
- Use tabs to protect the parts and the cutter.

Black - cut through.
Red -plate

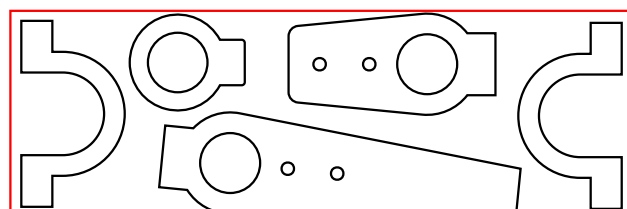


Rear Dropout Plates

Use file '6mmAliDropoutsNested.dxf'

Notes

- Use 6mm thick aluminium plate.
- Can be milled on CNC router or cut with a laser cutter.



Bottom Bracket Plate

Use file '12mmAliPartsNested.dxf'

Notes

- Use 12mm thick aluminium plate.
- Can be milled on CNC router or cut on a laser cutter.

Images



Headset locking collar



Display



Rear dropouts



Steering bar and bracket