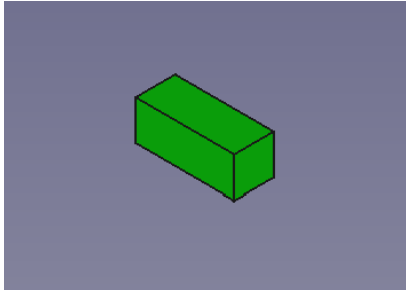


Illustrations and Folding

Green box in pictures is one inch wide, for scale.

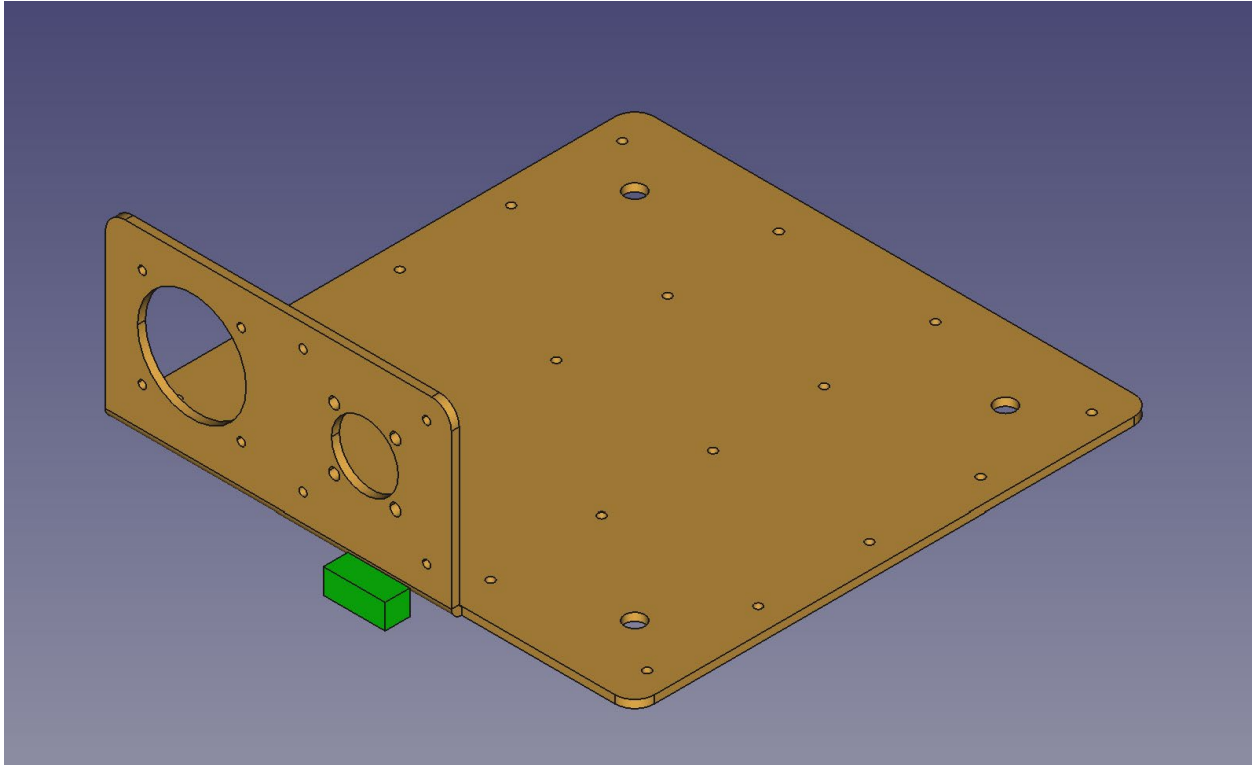


Flip means to turn over so bottom face now faces up. Rotate means turn so side that faced away now faces toward. All bends are 90* right angles.

List of parts and quantity needed:

Part	Qty	Folds?
A	1	Y
B	1	Y
C	1	Y
D	1	N
E	1	Y
F	10	N
G	1	Y
H	1	N
J	1	N
K	1	Y
L	1	Y
M	2	Y
N	2	Y
O	2	N
P	1	Y
Q	1	Y

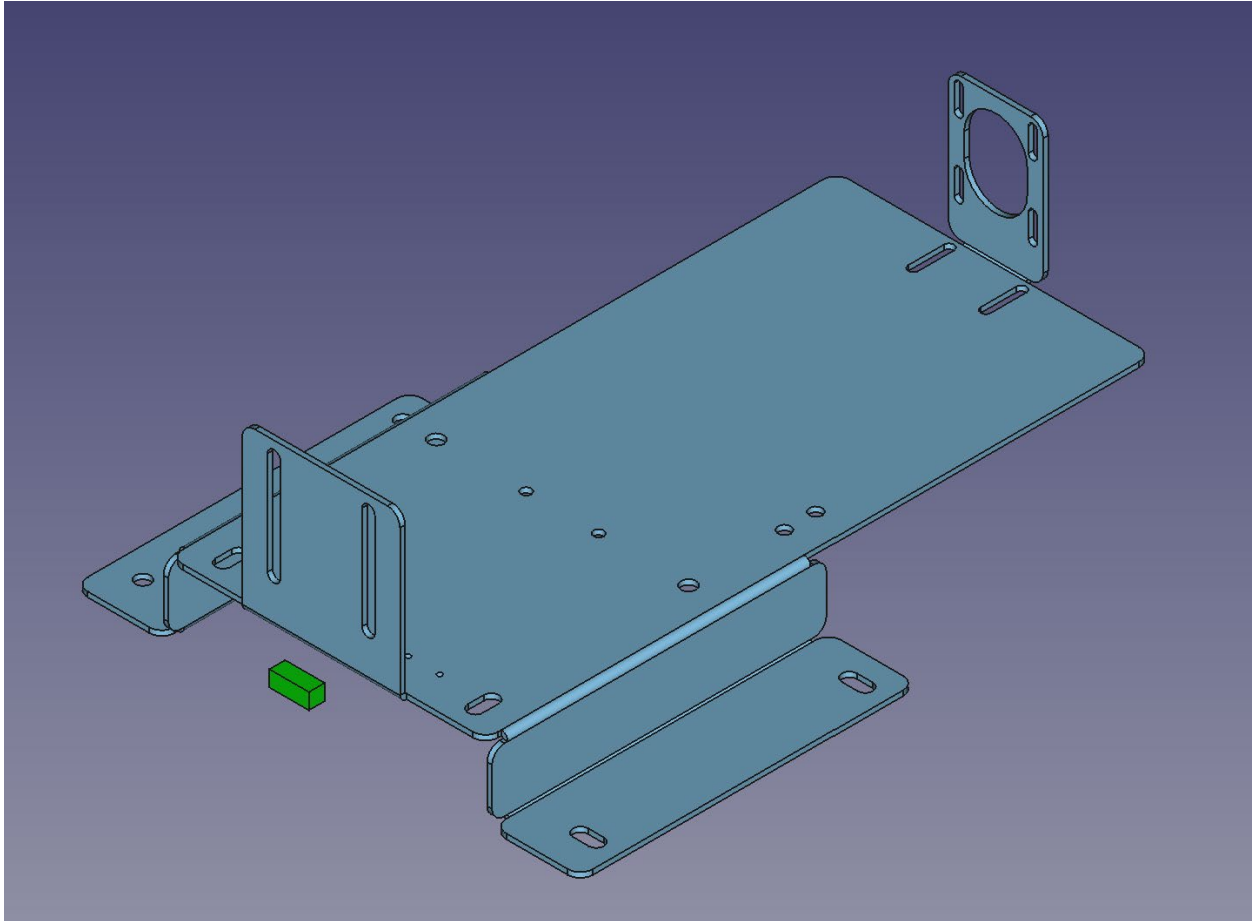
Part A x 1



One fold – gap in shorter end should be on right when held as depicted.

Insert into press with tab to the right, and gap to the left.

Part B x 1

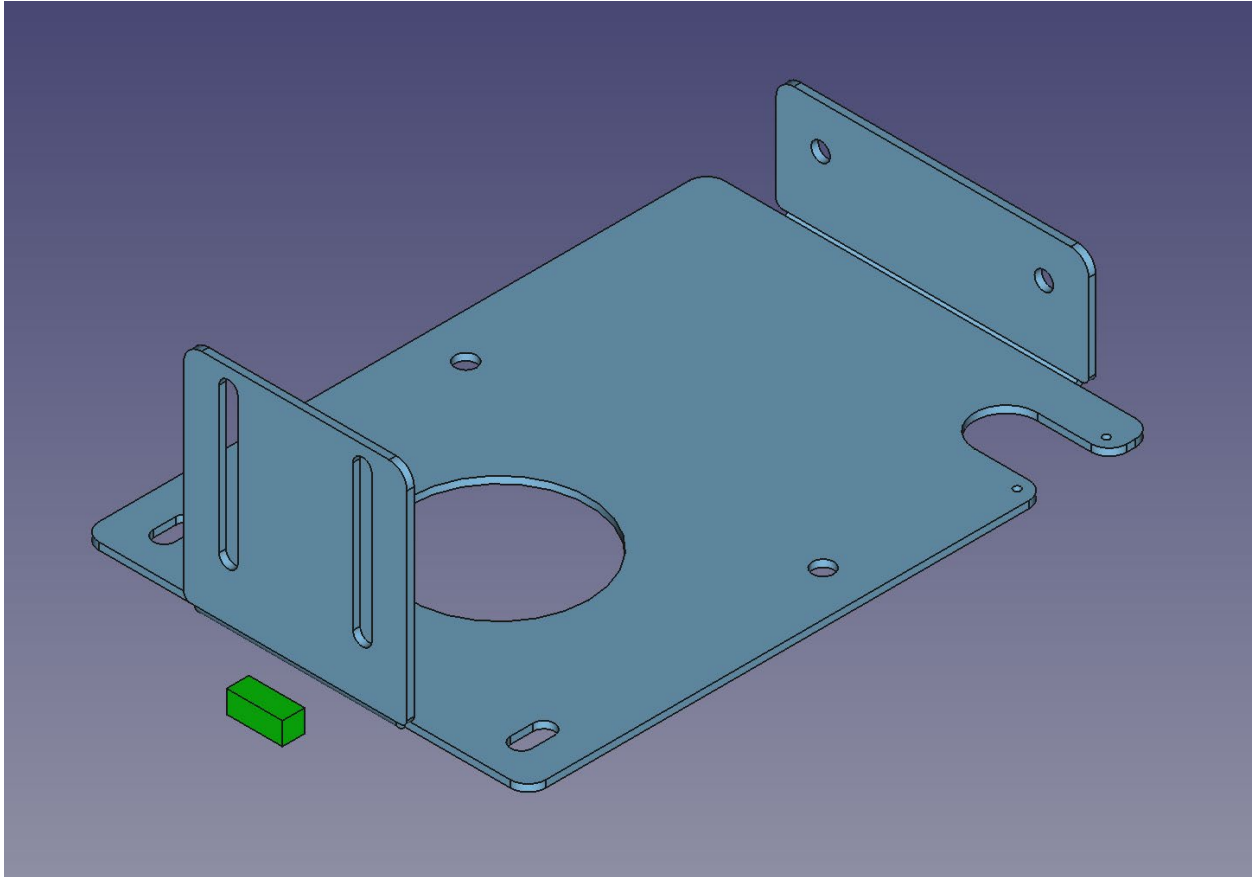


Two holes in middle should be on right when upper and lower tabs are folder upward. Side tabs (double-bent) fold downward.

To bend

- With holes to the right, insert top into press (rounded tab with large central hole).
- Rotate (but don't flip) and bend bottom to point in the same direction as top.
- Rotate again and bend outermost bend on both sides.
- Flip and bend the inner bend on both sides.

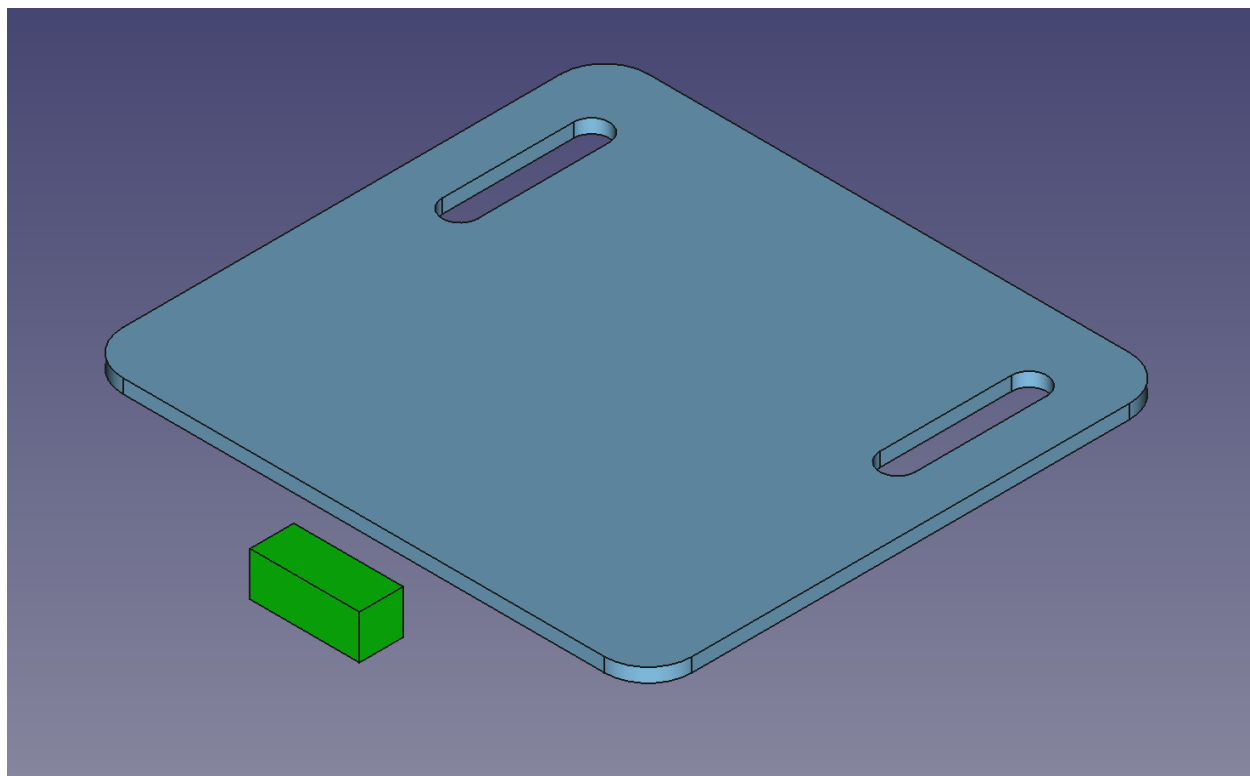
Part C x 1



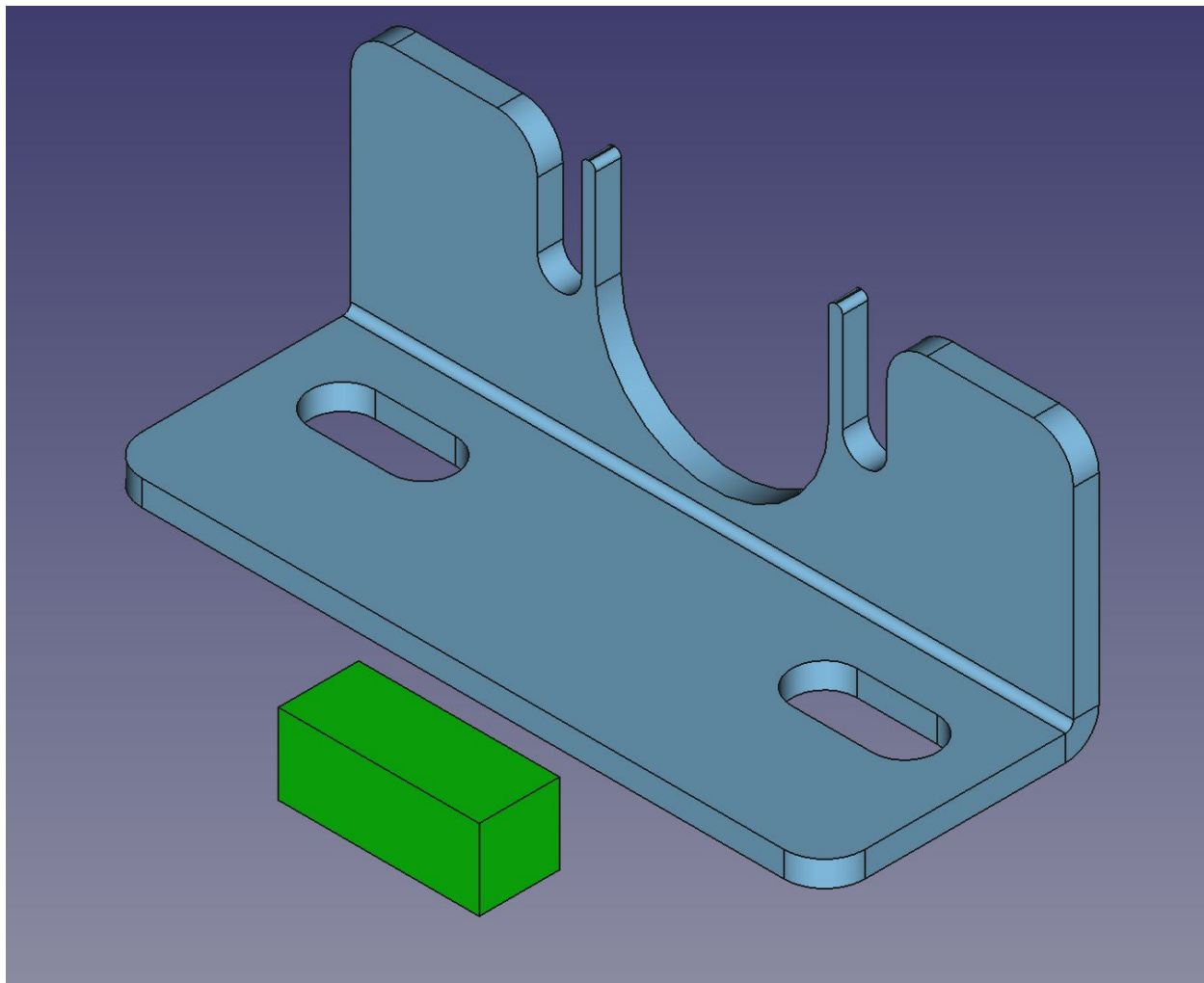
Folding

- With side notch on right, bend shorter tab with holes.
- Rotate (but don't flip) and bent bottom with long slots.

Part D x 1

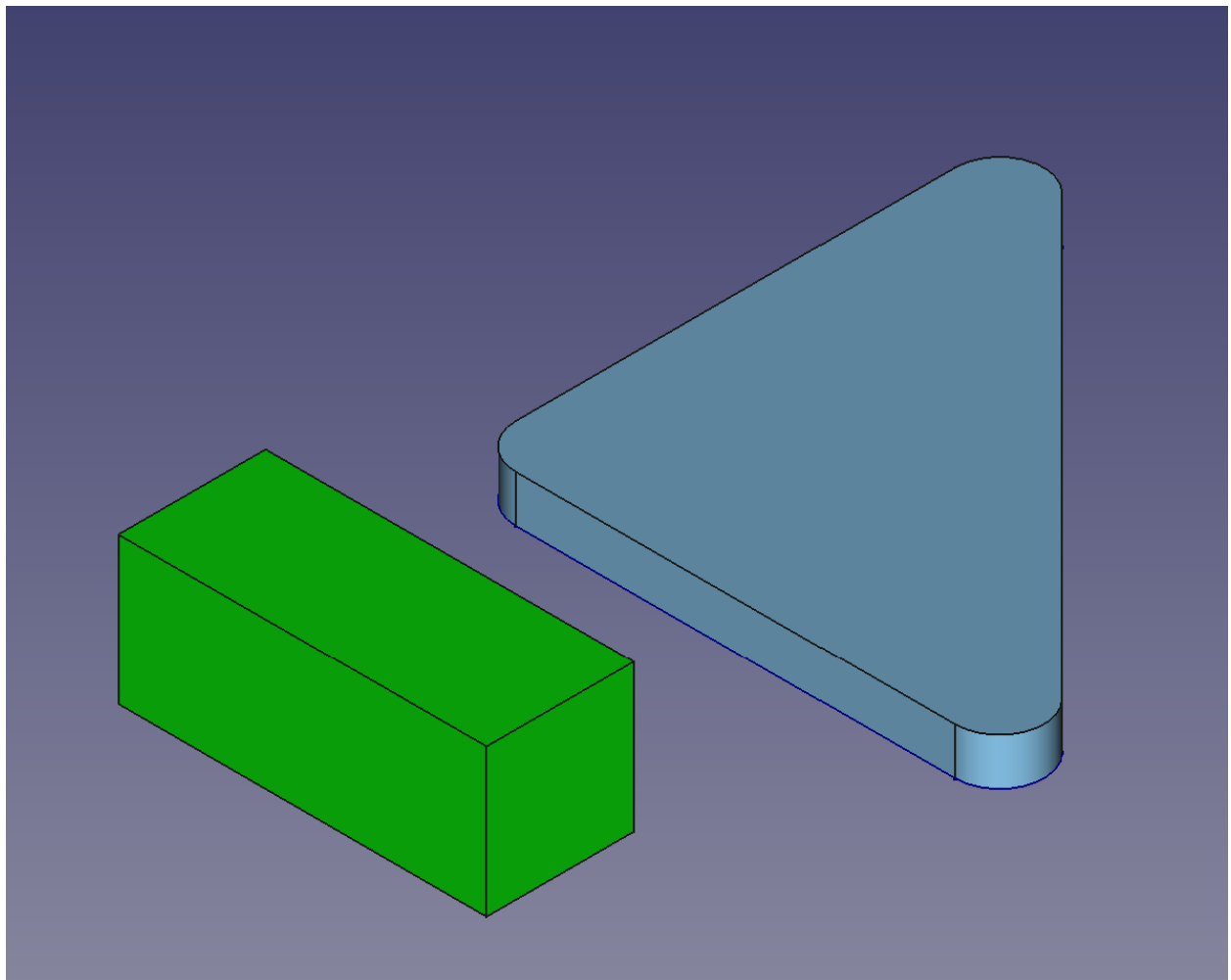


Part E x 1

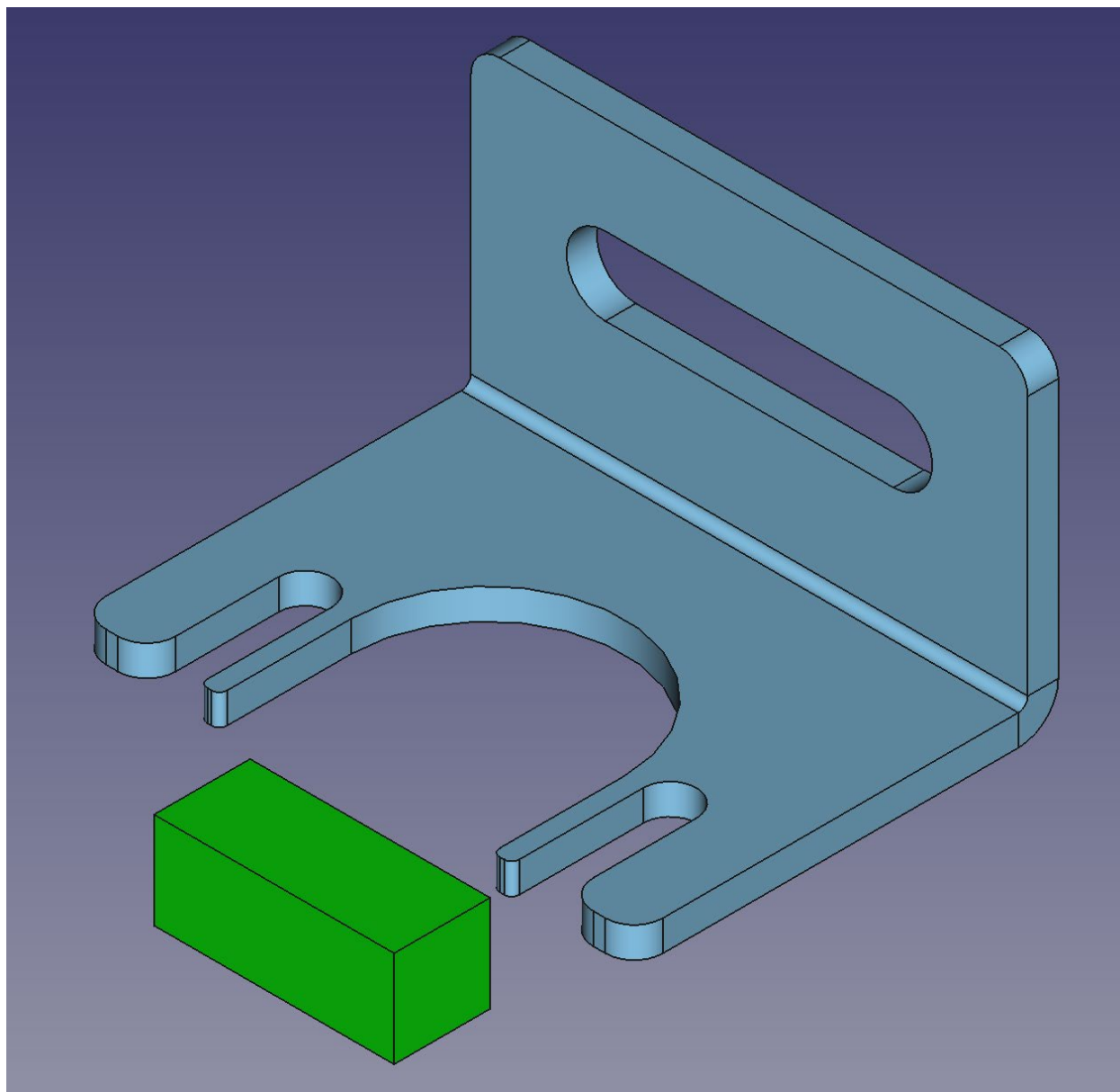


Fold along midline

Part F x 10

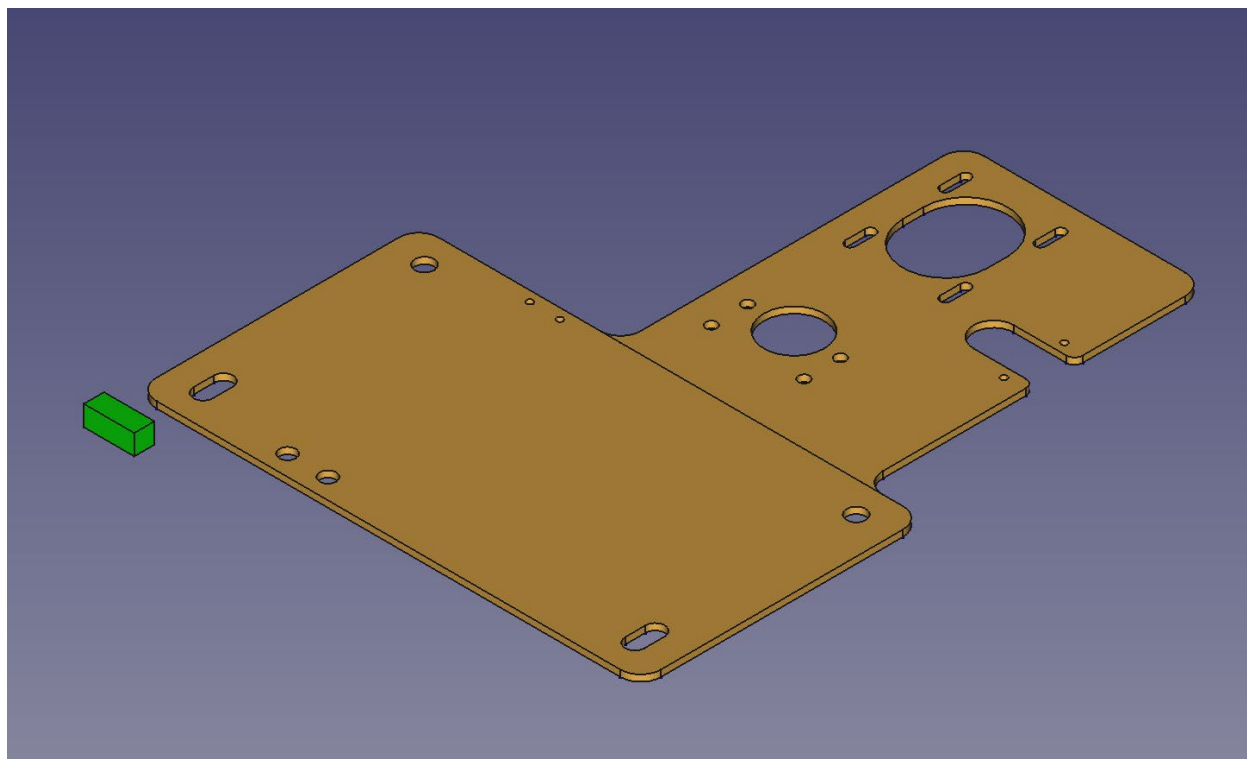


Part G x 1



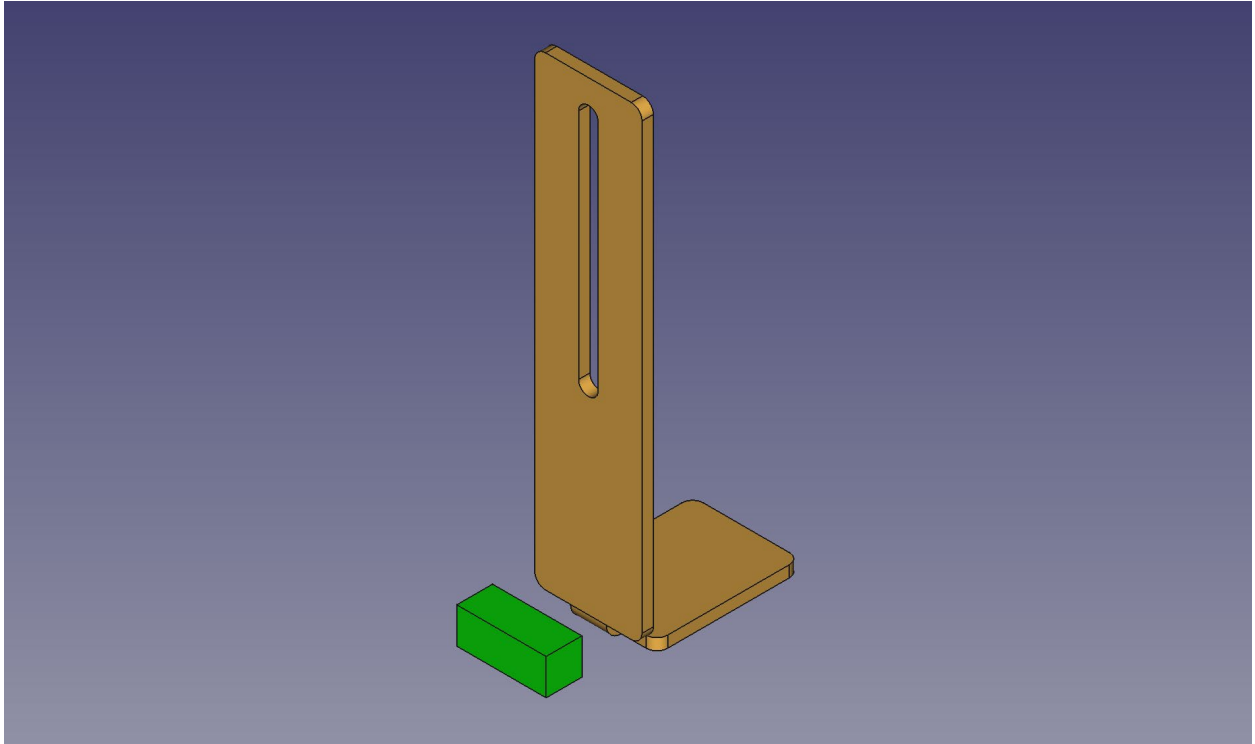
Fold along midline

Part H x 1



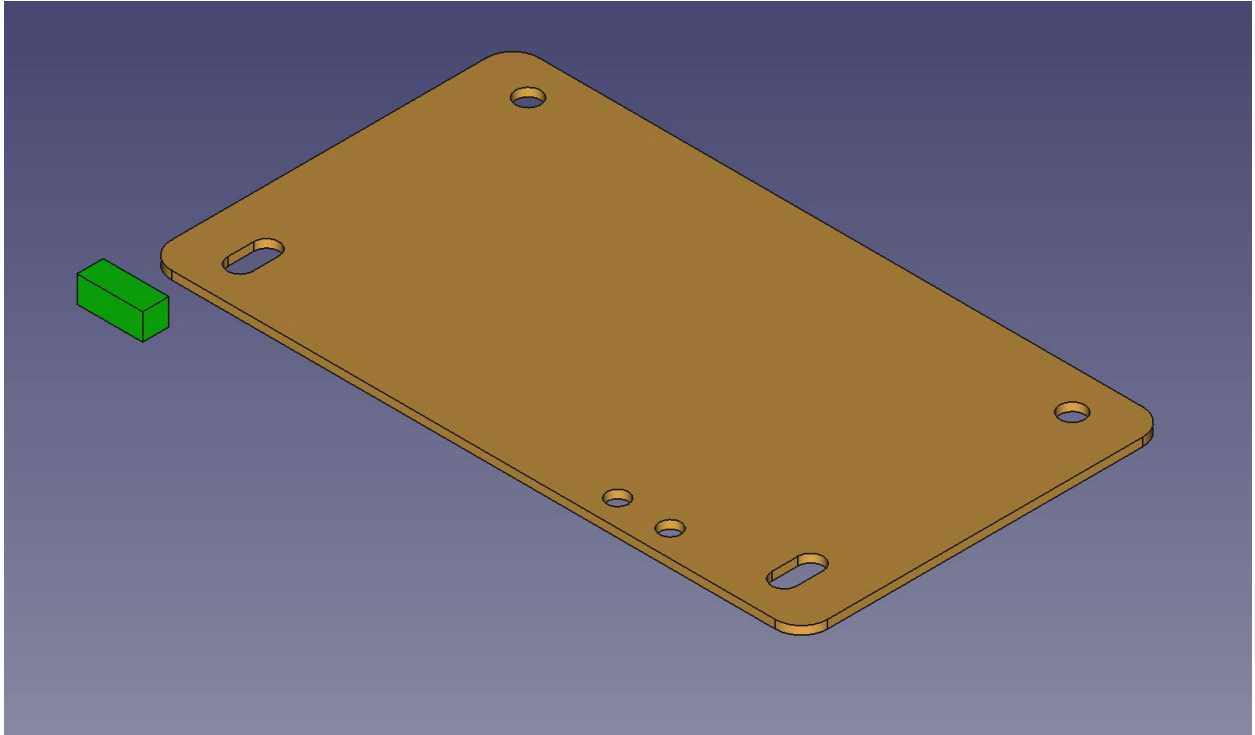
No folds

Part I x 1



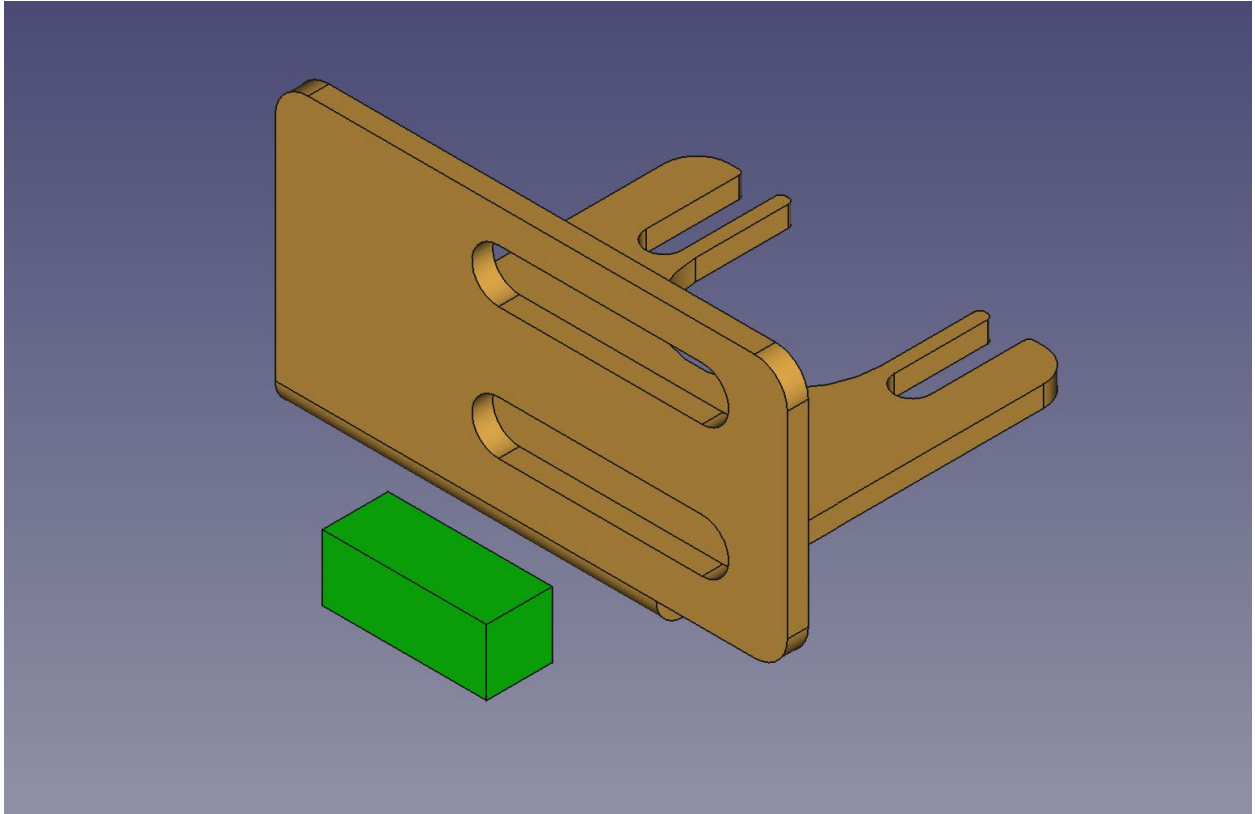
Fold at indent

Part J x 1



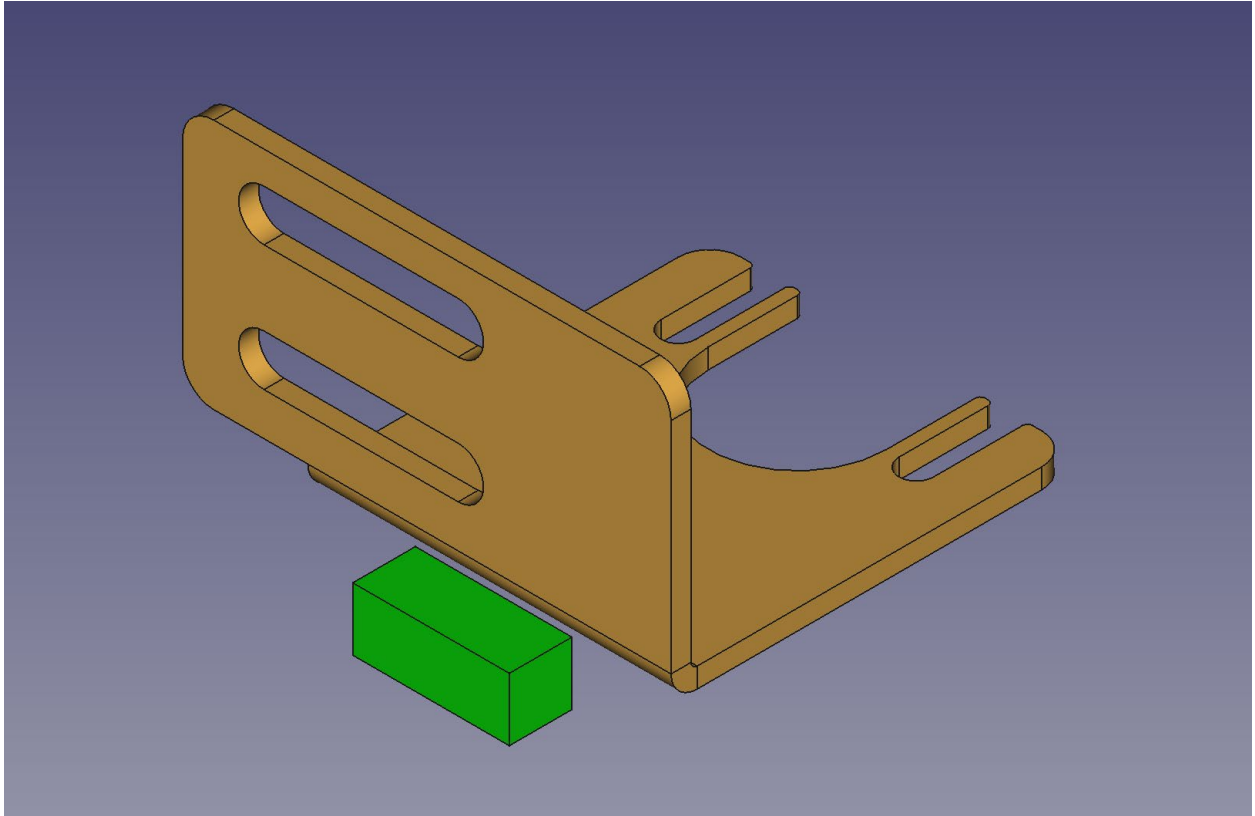
No folds

Part K x 1



Insert forked end while slots are to the right to fold.

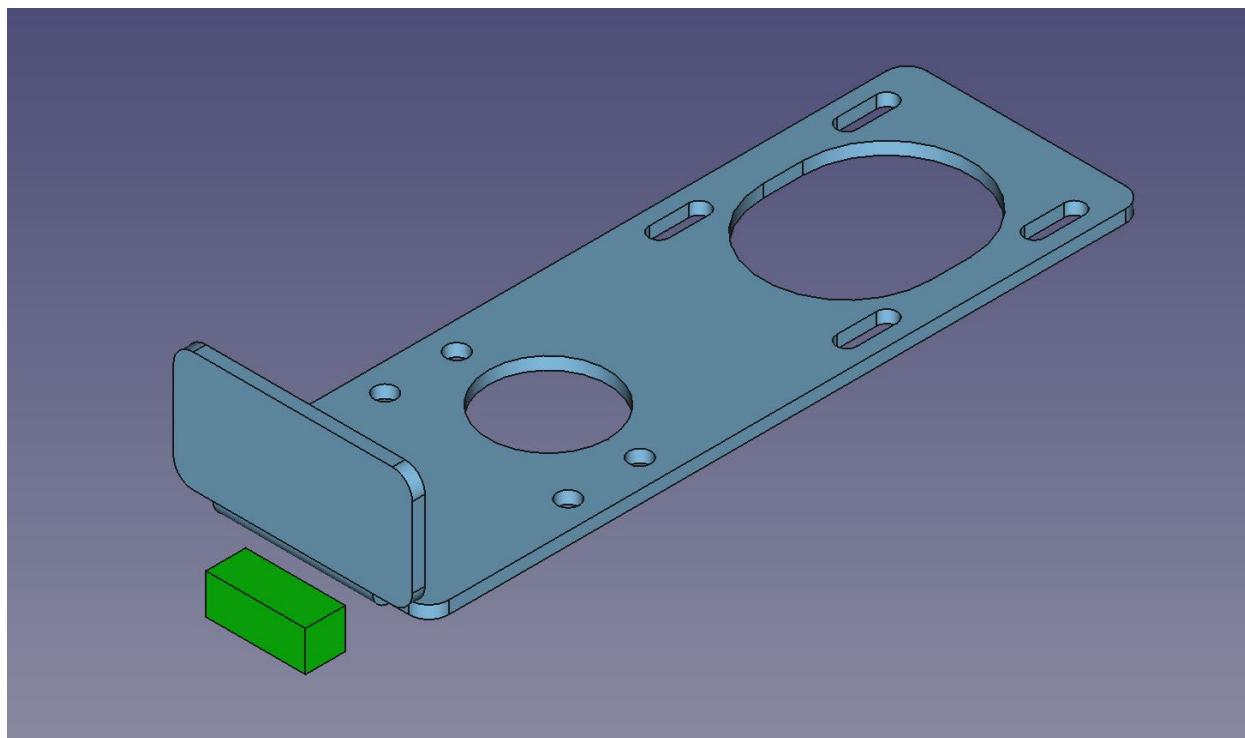
Part L x 1



Mirror of Part K.

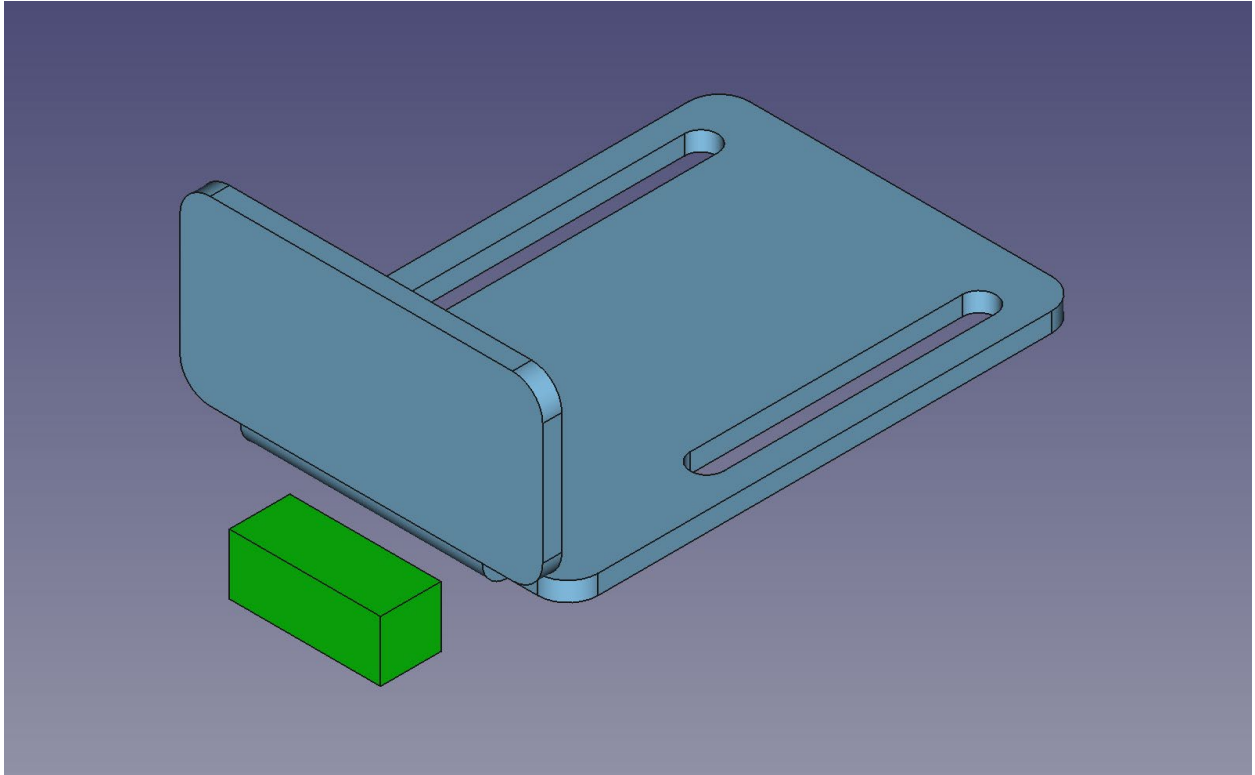
Insert forks into press with slots pointing left.

Part M x 2



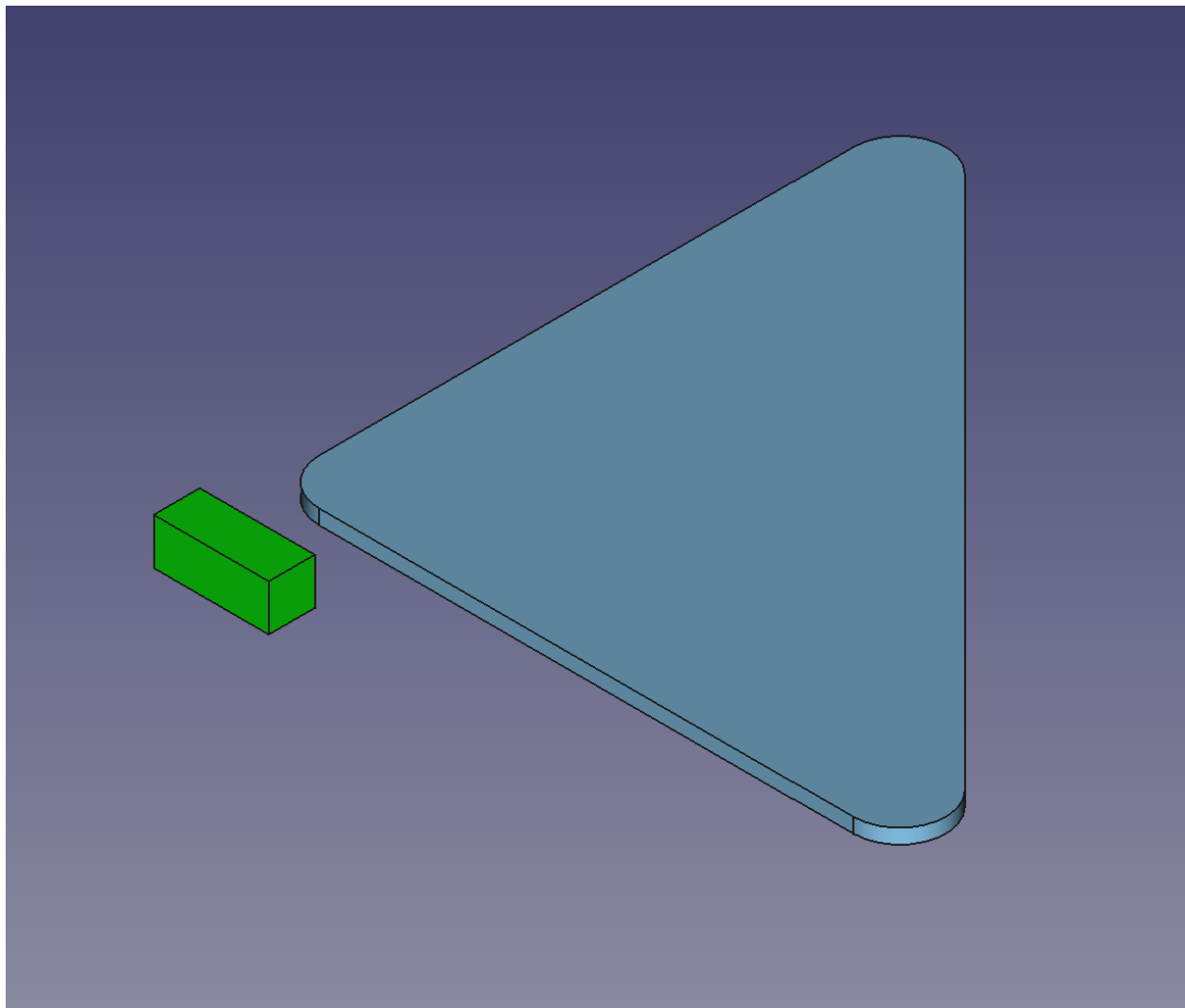
Fold bottom flange up.

Part N x 2



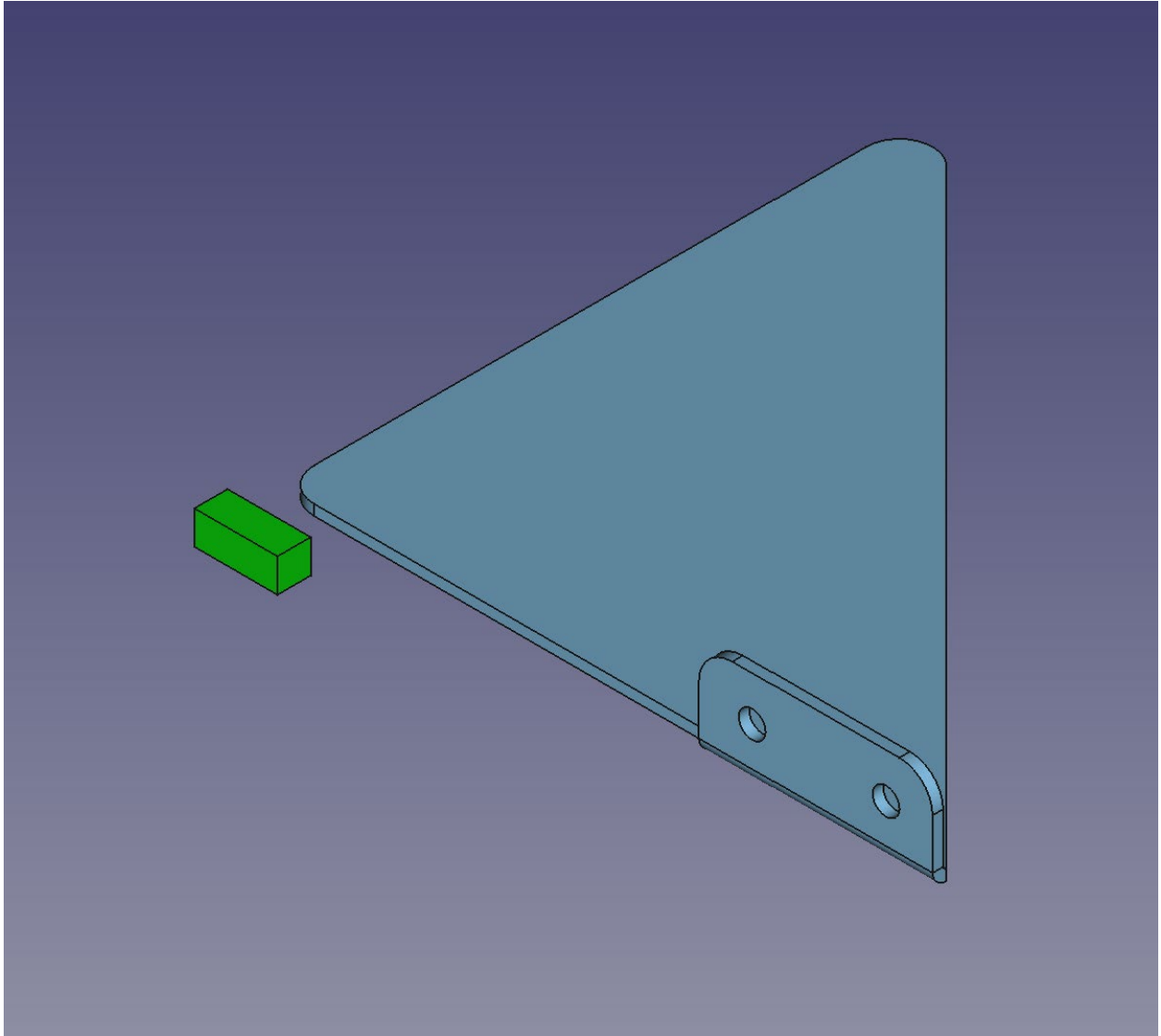
Fold bottom flange up.

Part 0 x 2



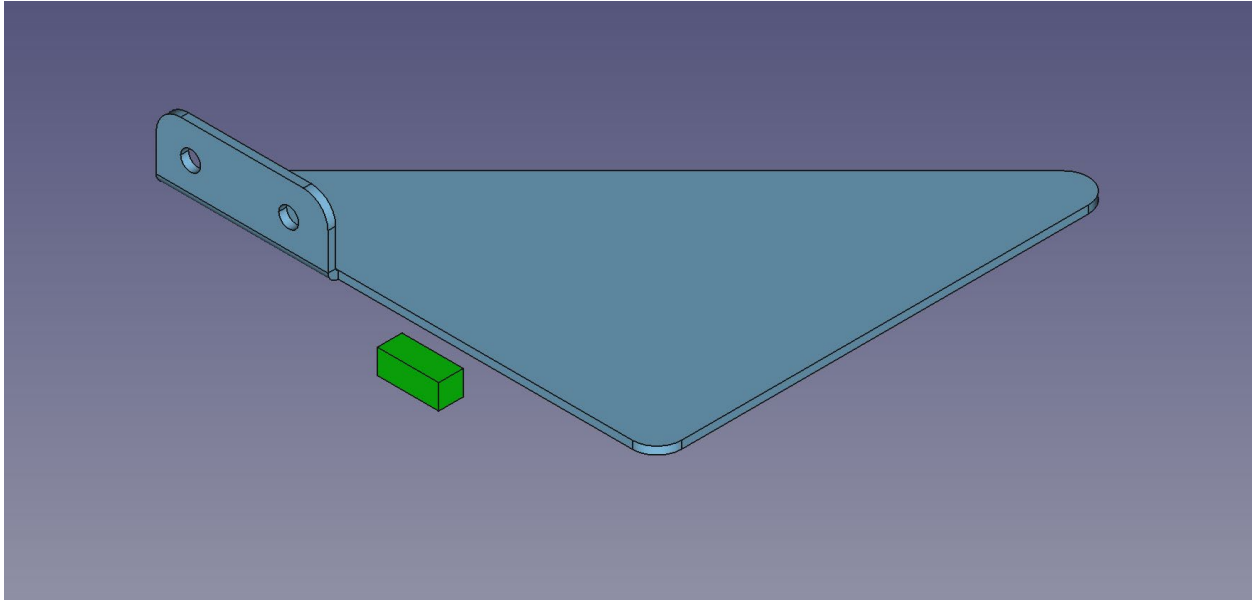
No folds

Part P x 1



Insert tab into press while tab is on the left side of triangle.

Part Q x 1



Is mirror of part P, uses same outline, but flipped over before bending.

Insert tab into press with holes aligned to the right.

Welding Directions

Use an extremely flat surface as the workbench for these processes. The alignment during the welding steps is highly dependent on the flatness of the working surface. A warped or uneven work surface will render the final machine far less operable and uniform.

Gantry

- 1 large beam
- 2 wider long rail plates
- 2 side plates (Parts H and J)

Roller Rails

Support the gantry beam from below using 12.5mm / half inch spacers so it is raised above the workbench. Center the wider pair of roller rails along the front and back faces of the gantry beam and clamp in place. The overhang both above and below the beam should be roughly equal. Weld a few beads, starting from the middle and alternating left and right sides, working out toward the edges. Weld between the beads to create one solid seam.

Side Plates

Lay the gantry on the two rails and position the end plates (Part H on the left side, and part J on the right side) so the gantry beam is normal to them. The two 8mm holes on parts H and J should be at the bottom front corner.

The gantry should be positioned towards the back of the plates. The bolt hole for the rear lower roller bearing should look roughly centered between the plate edge and the gantry. Ensure the plates are horizontally and vertically perpendicular to the gantry beam. Weld the front upper and lower corners of the beam and then the middle of the top of the beam, and finally the rear top and bottom corners. Finally, fill in the seam to completely enclose the interior of the beam, flip the gantry over to weld the bottom.

Frame Sides

The frame tubes are shorter than the tubes that will go under the frame.

- 4 long tubes (these are not the 4 longest tubes, but the ones that are slightly shorter)
- 4 short tubes
- 2 narrower long plates

Start the Frames

Ideally the four long tubes are exactly the same length. It's likely, that their lengths differ just slightly. Start the frames using the two shortest tubes so that at later steps you'll have a slight overhang instead of a slight underhand, and the resulting frame will be more rigid.

Lay one long tube on its side and lay a short tube flush with either end. Ensure a good 90° angle. Weld the inside edge, upper edge, and outer edge, but do not weld the bottom (surface that contacts the flat table). Mirror the pattern for the other side, so one frame is a C-shape and the other is a backwards C shape. You can rotate a frame on the workbench to change it from a C to a backwards C if both are the same so far.

Rolling Rails

Using the same spacers from the gantry, raise the remaining two beams about a half inch or 12.5mm off the flat surface. Mark the top of each beam. The beams should be lying on their wide sides. Clamp the rails on the short side of the tube with the rails centered on the beam.

Be sure to clamp one rail to the left side of a beam, and one to the right side of the other beam. If both are clamped to the same side, you'll have to flip one over. If the spacers aren't perfectly sized to half the overlap of the rolling rail, this will cause the gantry to be slightly uneven.

Attaching the Rails and Frames

Position the beams with the rails across the partial frames to create closed rectangles. The marked tops of the rail/beams should be toward the outside. Ensure all angles are exactly 90°. If the beam is not perfectly flush at both the front and back, prefer to make the back perfectly flush and have the front be slightly overhanging. Weld into place.

Ballscrew Attachments

Position Part M on the workbench side, inside the frame and below the rolling rail. The solid tab should point toward the far end of the frame. Position it far enough from the front edge of the frame that you'll be able to slide the gears onto and off of the ballscrew and stepper motors. About 50mm or 2 inches should be good. Weld into place along top and side but not bottom.

Attach the ballscrew to the front bracket, and loosely attach the pillow block on the far end of the ballscrew to Part N near the middle of the slots. Be sure the tab on the base of Part N points toward the back of the frame. Clamp in place. Remove the ballscrew and then weld this bracket to the frame along top and side but not bottom.

Reinforcements

In back bottom corner of each frame, weld the large reinforcement (Part O) to add additional rigidity to the structure.

Stand up the frame on its back face parallel and a few inches / 100mm from the edge – rails die closes to the edge. Align parts Q and P to the bottom rear corner of the frames. These parts should extend from the same side as the rails. The tabs should be just off the edge of the workbench pointed away from the

frame (toward the floor). Double-check that the bracket is perfectly parallel with the bottom of the frame. Weld these reinforcement brackets to the frames.

Base Tabs

Lay the frame down again on the unwelded side. Test align the long base rails to the bottom of the frame. Mark the distance between the inside edges of the front and back base tubes. Divide this distance by three and mark the bottom of the frame at the $1/3^{\text{rd}}$ and $2/3^{\text{rd}}$ point. Test align the other two base rails at these marks to evenly space the base framing.

Place angle bolt tabs along all inside corners, clamp in place and weld to frame. Do not weld to base bars.

Do the same thing on the bottom of the other frame.