# PART D

### MANUFACTURING DETAILS

Before commencing work, all sketches and workflow diagrams should be completed and referenceable. All working surfaces should be clean so that no measurement inaccuracies are possible.

To begin with, the edges of the plate are filed to clean up any roughness that may be present. Using the angle plate and the digital height gauge, the horizontal centre line and marks for the holes are marked. A dent is punched at the centre of the plate using a scriber or centre puncher. Arcs for the ends of the desired plate are then marked out using a divider and ruler (plate will be oversized), and also where the holes will be; and an engineering square and scriber are used to mark straight lines at those arcs. Dents are then punched where the holes will be using the scriber or centre punch and a hammer.

Before drilling the holes, the plate is positioned in the vice at a height suitable for comfortable drilling. The drill speed is set to 2 and the direction to clockwise, and the pilot drill is then inserted. The drill bit is centred where the place for the hole was marked out, and force is applied with abdomen as drilling is started. All the holes are then drilled in this manner before switching to the larger finish drill bit. Making sure the finish drill is centred in the smaller holes made by the pilot drill, each of the full-sized holes is drilled. To deburr the holes, a counter-drilling bit is used on speed 1 on both sides of the plate.

The plate is then repositioned lengthways in the vice, and the plate is cut through with the hacksaw slightly to the outside of the lines marked for the ends of the plate. Cutting is done with a flat blade back and forth along the whole length of the blade the whole way down, care being taken to keep outside the mark. The plate is then repositioned in the vice so that the cut side is uppermost, and filed down to the line. When the line is reached, the edges are briefly deburred with the file. This process is then repeated for the other sides till a perfect rectangle is attained, and the shape is checked with the square.

The plate is now positioned reasonably high in the vice, and the edges chamfered with the file. The plate is repositioned as many times as needed to chamfer all external edges. Finally, work is tested by placing it on a project-specific jig. If the plate drops into the recess and fits the pins, the job is done.

### OBSERVATIONS AND REFLECTIONS

* Take care that all measurements are accurate
* Plates will be oversized – we will need to cut them to shape
* When punching holes with scriber, use board rather than punching on the table
* Drill speed 2 for pilot drill, 1 for finish drill
* Don’t push the pilot drill the whole way in; finish drill is large enough that this doesn’t matter
* Since we’re doing Project A, we would use a 5mm finish drill
* When deburring, drilling in short bursts is all that is needed
* When filing, keep the file at a 45 degree angle to the top of the plate
* When close to filing through the plate, take care that you don’t lose control and cut youself on the sharp edge of the plate
* When chamfering, position the file at a 45 degree angle to the edge of the plate so we get a nice uniform edge
* Aim for a 1mm wide edge when chamfering
* Don’t forget the 4 corners! Just a few swipes with the file and they’re done

### DIFFICULTIES OBSERVED

* If plate is not a perfect rectangle (be prepared for this), we won’t be able to mark the vertical centre line
* When marking with the engineering square, be sure to not let it slip
* Make sure that you don’t lose control when the drill goes through the plate
* Be sure to file right down to the line on all sections of the surface (this may take a while)

### KEY LESSONS

* Safety is important – beware of sharp edges
* Precision is essential in engineering design – always be careful with measurements!
* Do all drilling with one drill bit before changing to another bit
* When filing, if one side is higher than the other, concentrate on that part

## SUMMARY

How did the actual manufacture differ from your teams Manufacturing Workflow Diagram? Why was this?

Looking back on this activity, what activity took the longest to complete, and why?

Thinking about the mass estimate, what have you learned about engineering estimating and significant figures?