MMAN1130 – Design and Manufacture

CNC Machining Assessment

Optional Peer review files submitted: Week 7 Thursday, 09:00am

Optional Peer review submissions due: Week 8 Tuesday, 09:00am

Finalised CAM files are due: Week 8 Thursday, 09:00am

Weighting 25%

Task

You will be utilising all the skills you have learnt so far to manufacture two components using CNC Milling machines located on campus. You will create 3D CAD models from an engineering drawing customised to your zID. You will then generate the necessary milling processes required to manufacture these components. The stock dimensions for manufacturing your components are 50 x 50 x 12 mm. These components will then be compliance tested in terms of dimensional accuracy as well as functional performance (do they fit together?).

Computer-aided Design

You will need to complete the following tasks for the CAD component of this assessment.

1. You must produce a CAD model based off the engineering drawing in Teams titled "CNC Machining Assessment Primary Component" using Solidworks.
    a. Save this file as "zID_Primary_Model".
2. You must then design a complementary CAD model based off the provided engineering drawing such that the two components fit together as best as possible (see Figure 1). Some features will be more difficult to design and subsequently manufacture than others. You will need to make a decision about what you feel comfortable achieving. **Note, these two components are required to have a "clearance fit" during assembly.**
    a. Save this file as "zID_Complementary_Model".

Failure to use your zID specific dimensions when creating the 3D models will result in a 50% penalty to your overall CNC Machining Assessment grade.

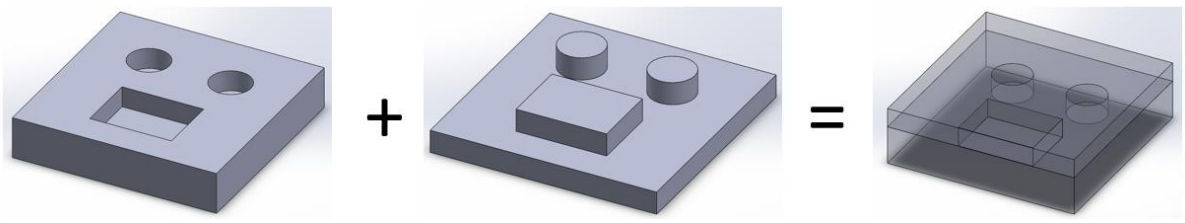

Figure 1. The provided primary component and designed complementary component are required to fit together.

Hints when creating the CAD in preparation for manufacture!!

There are a few key things that we need to keep in mind when designing parts for manufacture. We are leaving behind the virtual world of perfect dimensions and need to consider tolerancing systems for critical features. The Tormach typically has an accuracy of ± 0.05 mm when machining. This means that rather than creating CAD files with nominal (perfect) dimensions, you will need to dimension features to account for required clearance considering worst-case scenarios.

For example, let's assume that you have a ϕ10mm hole that needs to accept a ϕ10mm circular shaft. In a worst-case scenario, the ϕ10mm hole will measure at ϕ9.95mm and the ϕ10mm circular shaft will measure at ϕ10.05mm after machining. As a result, these parts will only fit under interference fit conditions, perhaps they won't even fit at all. They will definitely not be a clearance fit.

After you have designed and modelled your complementary component, you can check how well they fit together using the Assembly feature in Solidworks. You can also modify the transparency of the components to visualise features that may not easily be seen once the two components are mated.

Computer-aided Manufacture

Once you have your two components modelled in Solidworks, it is time to begin preparing them for manufacture. Ensure that you are using the "MMAN1130 CNC Assessment Tool Crib" when preparing your components for manufacture.

A video tutorial of how to import your Solidworks CAD models into the "CAM FIXTURE ASSEMBLY" file has been uploaded to Teams and is titled "CNC Machining Assessment Setup Video Guide". You will need to complete the following tasks for the CAM component of this assessment.

1. **IMPORTANT: Rename the Solidworks Assembly file title "CAM_FIXTURE_ASSEMBLY.SLDASM" to "zID_CAM". E.g. z3414114_CAM.**
2. Open the renamed assembly file.
3. Import the two CAD files and mate them to the correct position in the fixture plate as per the video tutorial.
4. Generate the necessary milling operations and tool pathways.
5. Using the simulate feature, ensure that your parts are able to be manufactured within 13 minutes. Note, the most efficient machining time is desirable.
6. Once your CAM file is ready for submission, save is as a Pack and Go Zip file named zID_CAM_Programming.

Things to check during simulation:

- There are no tool collisions with the fixture, other student's stock pieces, etc.
- You are spot drilling before drilling operations.
- The endmill operations are complying with the cutting rule, $1.1DOC\% * WOC\% = 0.2$.
- The time limit has been met.

Manufacture of Your Components and Compliance Testing

Before manufacture of your components can commence, your CAM files will undergo a manufacturability review by staff. This is a very important check that ensures we will be able to manufacture everyone's components in the timeframe whilst preventing downtime and expensive equipment failure. Common issues that prevent manufacture are choosing the wrong tool for an operation (e.g. face mill for adaptive clearing) and violating the endmill cutting rule by not **carefully** checking the simulation. The manufacturability review will be completed by 18:00 on Monday, Week 9. Students that have manufacturability issues will be contacted via their student email the following day. Manufacturing of components will be live-streamed and will begin on Tuesday, Week 9.

If your CAM file passes the manufacturing review on the first time, you will be awarded a 7.5% bonus to be applied to your CAM mark. E.g. If you achieve 20 marks, you will receive 1.5 bonus marks. If you achieve 30 marks, you will receive 2.25 bonus marks.

If your CAM file is found to have violated the manufacturing requirements, you will be allowed to fix the issues and resubmit for a 15% penalty applied to your CAM mark. The deadline for re-submission will be 09:00 on Monday, Week 10. You don't have to re-submit but we won't be able to manufacture your part, and subsequently we won't be able to perform compliance testing.

Compliance testing will be live-streamed and is currently scheduled for Week 12.

(Optional but Recommended) Peer-Review of CAM Simulation

You have the option to participate in a peer review of your CAM files. By submitting your files to the Peer Review tool on Moodle, you will be allocated 3 students CAM simulations to peer-review as well as receiving feedback from 3 other students. This is an opportunity to improve your simulation AND minimise the chance that an incorrectly generated CAM file will break the fixture, tool or machine. You will also be checking that their simulation time is within the 13-minute constraint.