Sample portfolio: Level 1 Merit

NCFE Level 1/2 Technical Award in Engineering

QN: 603/2963/4

Contents

Introduction

The material within this portfolio relates to:

Unit 02 – Skills and techniques in engineering (K/616/8969)

This portfolio is designed to demonstrate an example of the evidence that could be produced for Unit 02 of the Level 1/2 Technical Award in Engineering. It's designed to provide guidance on how a portfolio could look, rather than being prescriptive.

In this example there are written accounts and visual evidence, but the evidence could also be presented in an audio/video format. Where the learner has provided visual evidence (for example screen grabs, copies of research), this has been clearly annotated to give context as to why it has been included. Each piece of evidence has been presented with the assessment criteria number shown at the top of the page.

This portfolio contains manufactured learner evidence and assessor feedback produced by NCFE. External Quality Assurer guidance has also been provided for each piece of evidence relating to an assessment criterion. The guidance comments on how the evidence meets the assessment criterion and what could be improved to obtain a higher grade.

Synoptic Project Tasks

Project Brief

You work for a mechanical engineering company who manufacture hydraulic equipment for the construction industry.

You have been asked to design a new model of hydraulic excavator and are required to produce a **working scaled model** of the machine to present to the board of directors.

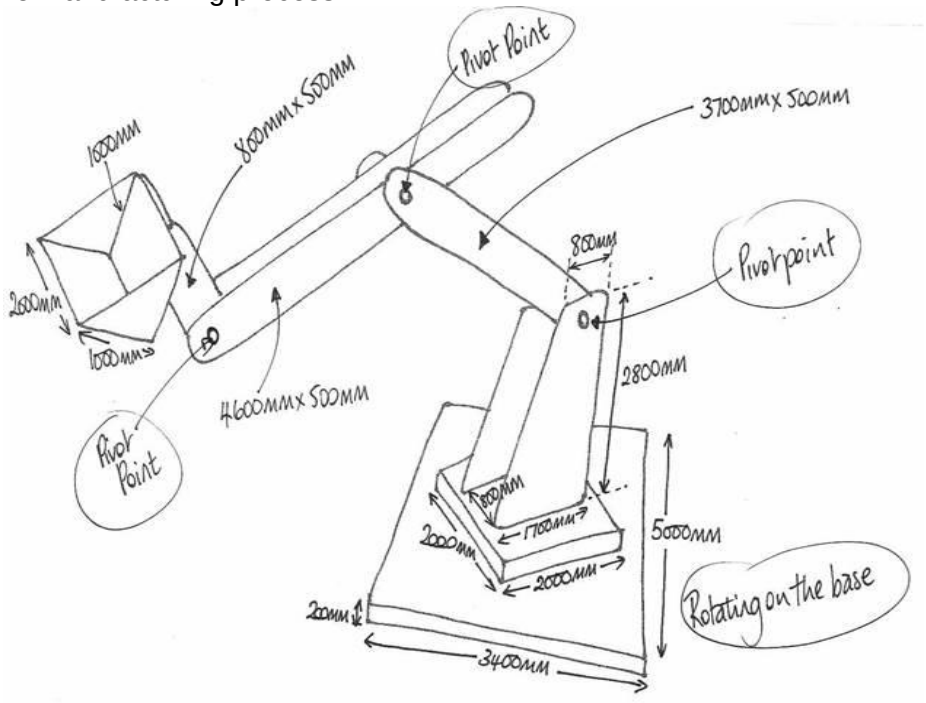
You have been provided with a basic drawing of a hydraulic excavator with all relevant parts labelled. Use this sketch where required throughout the project.

You are required to produce a **portfolio of evidence** to accompany your model of a hydraulic excavator.
The portfolio should include:

- CAD **and** hand-drafted engineering drawings of your hydraulic excavator using the given information in the sketch
- evidence of materials, tools and machinery testing
- a production plan
- an evaluation of the project, making reference to your learner log where appropriate.

Using your **engineering drawings** and **production plan**, manufacture your hydraulic excavator to an appropriate scale of choice, selecting and using the most appropriate materials, tools and techniques.
During the manufacturing process, you should:

- demonstrate that you are able to carry out manufacturing techniques
- evidence how you demonstrated safe and correct use of a variety of tools and/or machinery throughout the manufacturing process.



Learner log and project evaluation

As you work through the project, you are **required** to keep a learner log to record your approach. You should include:

- how you prepared
- what resources you used
- how you managed your time.

You **must** use your completed learner log to carry out an evaluation of the project.

Evidence

You are required to submit the following for assessment:

- your portfolio of evidence
- your model of the hydraulic excavator
- your learner log, including your evaluation.

Types of evidence

Below is a list of suggested types of evidence that you could include:

- written/word-processed documents
- presentations
- diagrams
- annotated evidence to include photographs, image and diagrams
- technical drawings
- video/audio evidence
- witness statements (as supporting evidence)
- learner observation records (as supporting evidence).

During the project, you will need to refer to the 'Project Brief' to obtain information.

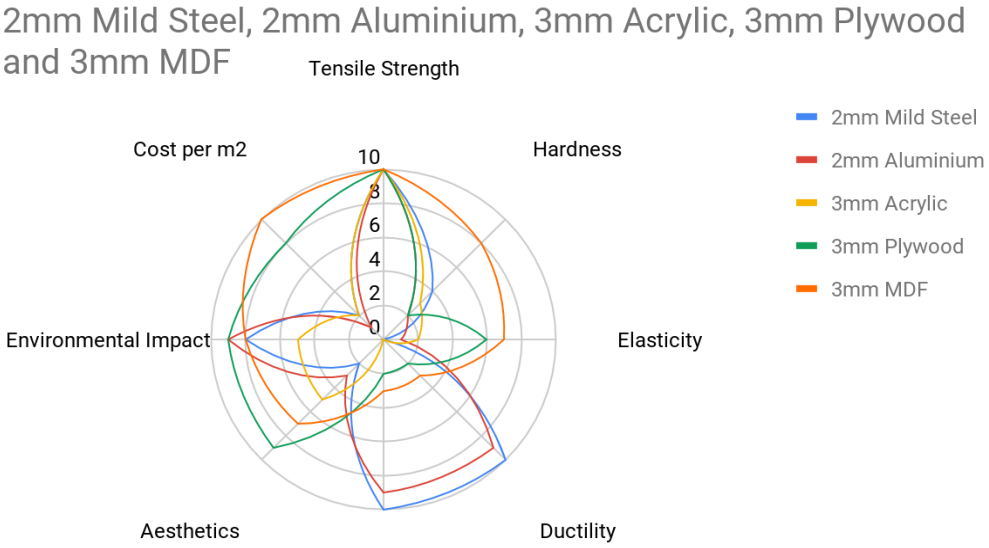
Learner Evidence

MATERIALS TESTING

PROPERTY	*DESCRIPTION*
Tensile Strength	*Measured by fitting into a vice, and hang weights off the other end*
Hardness	*Measured by dropping a 1 inch diameter ball bearing down a tube onto material and measuring the height of its bounce*
Elasticity	*Measured by fitting into a vice, and hang weights from a piece of string off the other end, then cut the string and measure the spring back.*
Ductility	*Measured by fitting into a vice, and use a lever to fold the material to 90 degrees inspecting the outside*
Malleability	*Measured by fitting into a vice, and use a lever to fold the material to 90 degrees inspecting the inside*

MATERIALS PROPERTIES TESTING RESULTS

PROPERTY	2mm Mild Steel	2mm Aluminium	3mm Acrylic	3mm Plywood	3mm MDF
Tensile Strength	10	10	10	10	10
Hardness	4	2	3	2	8
Elasticity	0	1	2	6	7
Ductility	10	9	0	2	3
Malleability	10	9	0	2	3
CHARACTERS	2mm Mild Steel	2mm Aluminium	3mm Acrylic	3mm Plywood	3mm MDF
Aesthetics	grey 2/10	silver 3/10	blue 5/10	light wood 9/10	brown 7/10
Environmental Impact	8	9	5	9	8
Cost per m2	£32.47 2/10	£38.73 1/10	£32.95 2/10	£6.40 8/10	£4.12 10/10

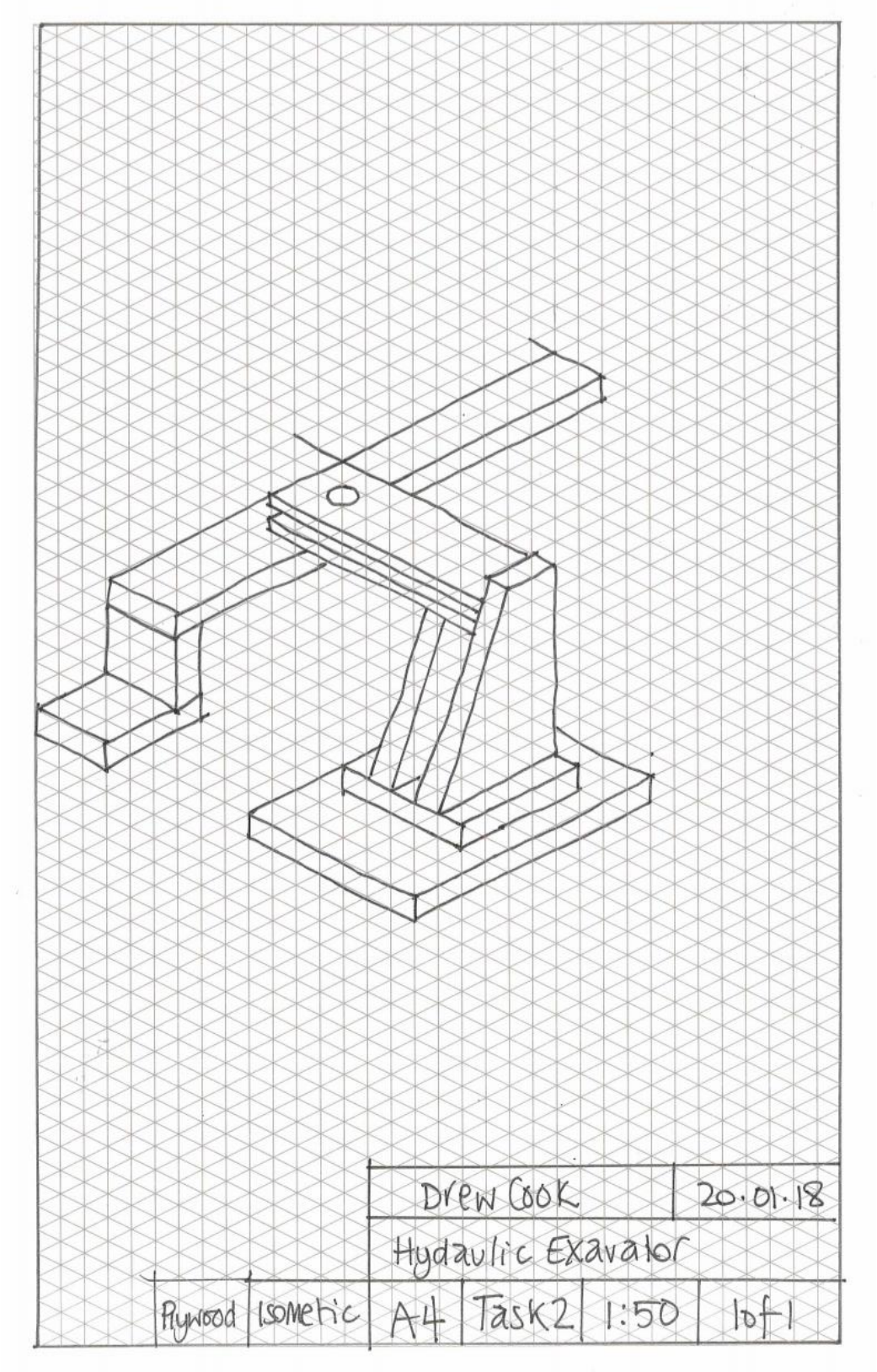


SELECTED MATERIALS, COMPONENTS AND TOOLS WITH JUSTIFICATION

MATERIAL	JUSTIFICATION FOR USE
Model pieces will be made from MDF	I am going to use MDF as the base, sides and part of the arms to that it can hold itself up, I chose the MDF so that it can hold up most of the weight of the hydraulic arm rather than just the wooden dowels.
Components - 3mm dowel rod	I am going to use the dowels to feed through the wood, then I can use them to attach the nylon cables so that it could hold the syringes in place.
Components - Nylon cable ties	I am going to use nylon cable so that I can attach them to the syringes and the dowels, this is so I can keep the hydraulics in place so that it won't move about when pressure is being put through...
Components – plastic syringes - filled with coloured water	I am going to use the syringes so that it can be used as the hydraulics, the water is pumped through, and the arm can lift up and down. I used it so that it can hold pressure inside.

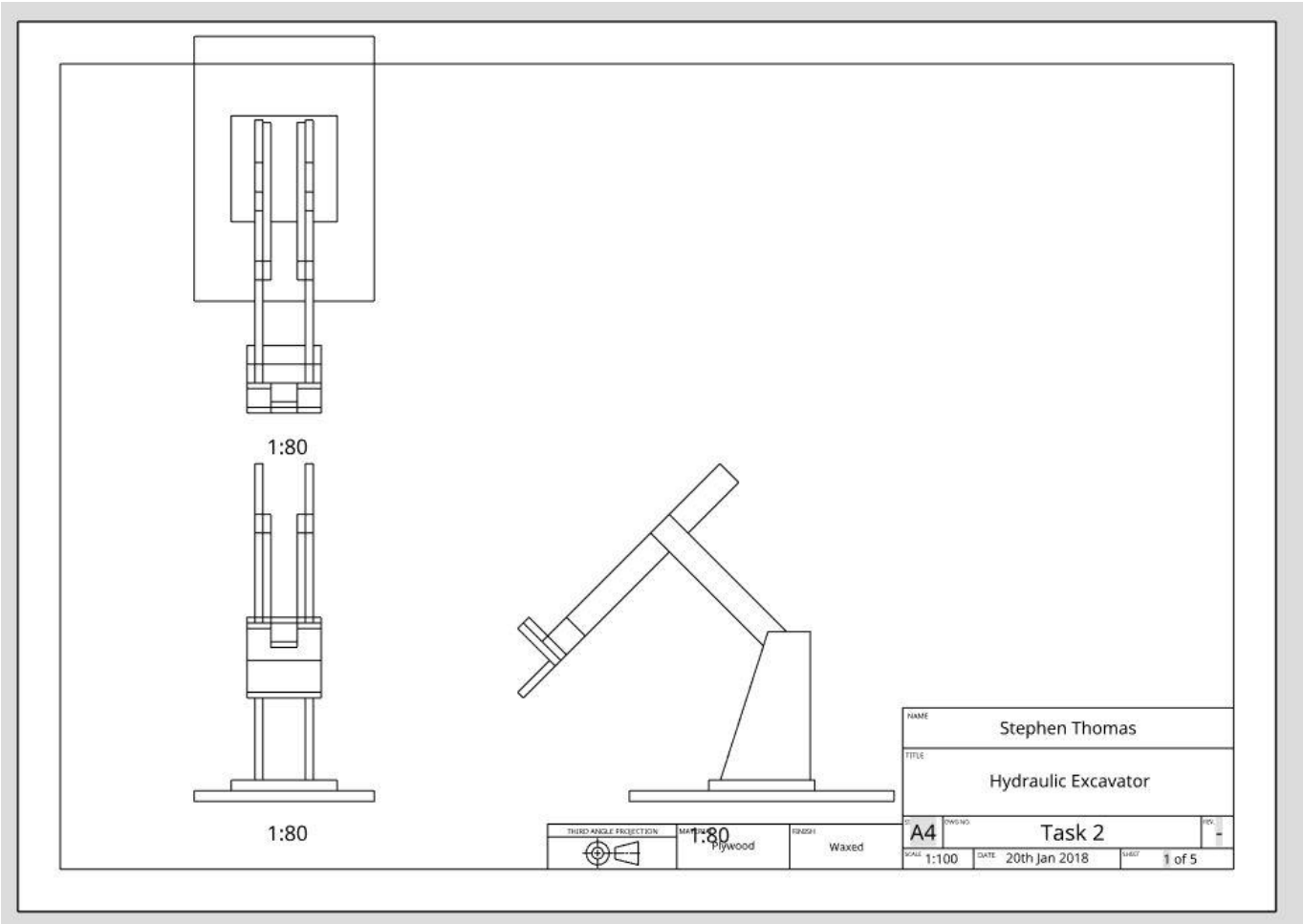
TOOLS & MACHINES	JUSTIFICATION FOR USE
Hand Tools	For hand tools I have chosen a tenon saw and pliers. I can use the tenon saw so I can cut the hydraulics arm correctly and to get a straight cut. I have chosen to use the pliers so that I could nip off the wooden dowels to size so that they are not too big.
Power Tools	For power tools I have chosen to use the cordless, battery powered hand drill so that I could drill the holes (which were 3mm) so that I could fit the dowels through. I used the orbital sander to smooth off the edges. I used a glue gun to glue the dowel to the mdf.
Fixed Machine	For fixed machine I used the pillar drill so that I could drill the holes (which were 3mm) so that I could fit the dowels through.
CAM	For fixed machines I used the laser cutter to cut out precise pieces, from the CAD pattern. I used the disc sander to smooth off the edges.

HAND DRAWINGS - Isometric Projection

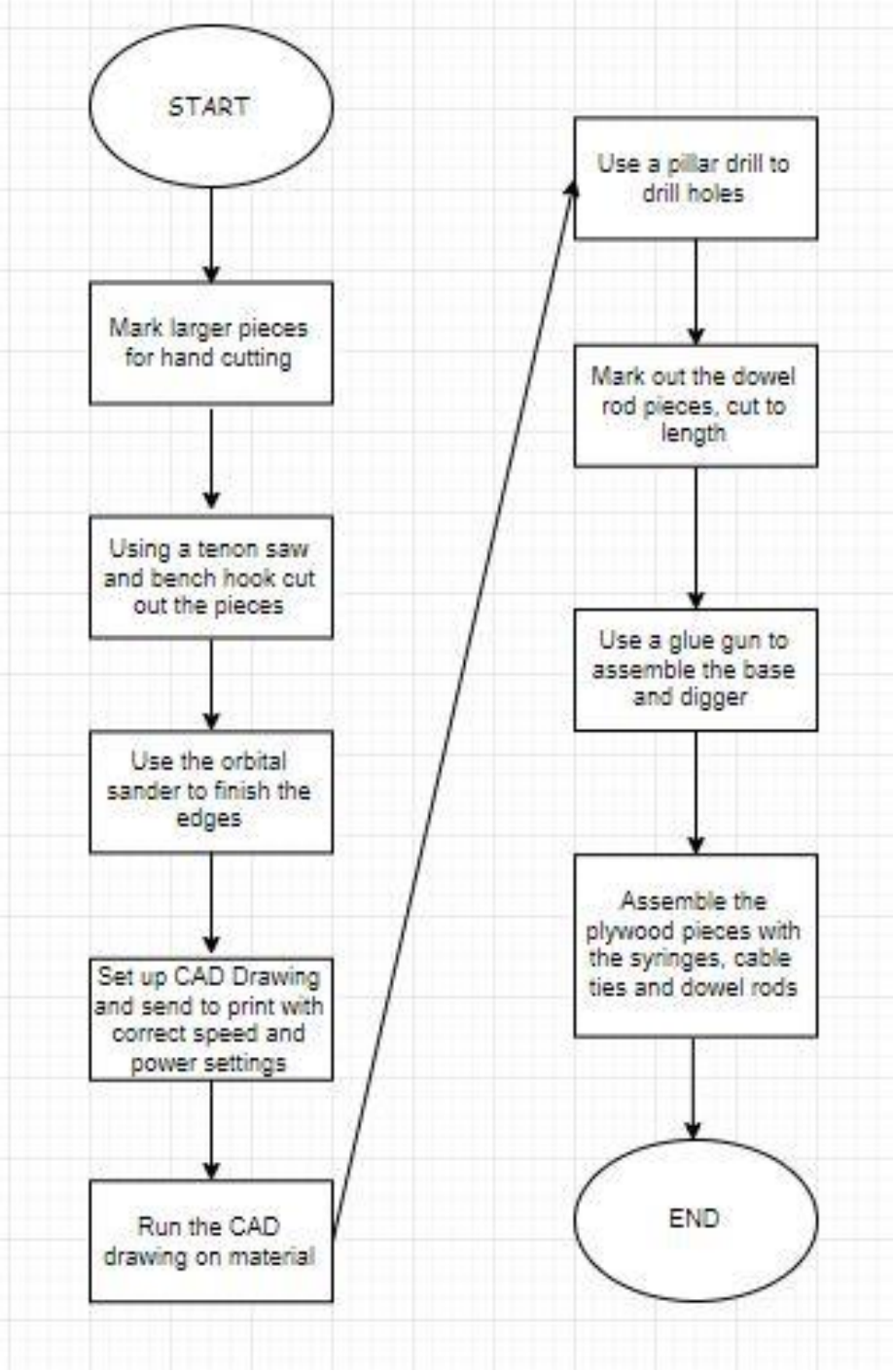


Contains basic information

CAD DRAWINGS - Third Angle Orthographic projection



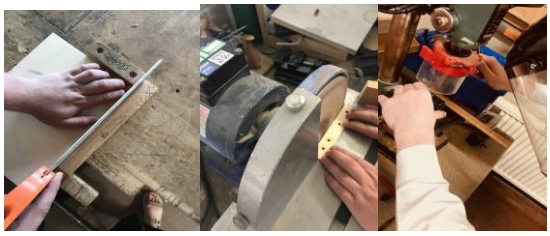
PRODUCTION PLAN - FLOW DIAGRAM



PRODUCTION PLAN – RISK ASSESSMENT FOR A PILLAR DRILL

Hazard/Danger	*People at Risk/Outcome*	*Safety Measures*	*Further Safety Measures*
Fast rotating machinery/Drill	*People at risk: Students or Teacher. Outcome: Clothes could get caught in drill and pull you in.*	*Safety measures in place to reduce risk: Emergency stop button on drill and in the room/adequate training on basic use of drill.*	*Further safety measures in place to reduce risk: Drill guard to stop clothes from getting pulled in.*
Swarf/Debris	*People at risk: Students or Teacher. Outcome: Damaged eyesight.*	*Goggles/drill guard to stop swarf/debris from damaging eyesight.*	*Adequate training on how to use drill safely and emergency stop button to stop swarf/debris from injuring anyone*
Incorrectly fitted drill part	*People at risk: Students or Teacher. Outcome: Incorrectly fitted part could come loose and hit somebody causing harm.*	*Emergency stop button on the machine and in the room encase you notice that a part is not fitted correctly.*	*Adequate training on how to correctly setup pillar drill.*

Practical Progress Log

	Tool or machine Used	*Description of progress log entry*	*Photographic evidence.*
1	*Laser Cutter*	*I measured and marked out using a ruler, trisquare, tape measure and pencil 600mm x 400mm to be cut to fit the laser bed.* *I then set up CAD Drawing from my 2D Design file, making the amendment to the laser and send to cut.*	
2	*Tenon saw* *Disc sander* *Pillar drill*	*I measured and marked out the larger pieces such as the base. I used a tenon.* *I used the disc sander to finish the edges to ensure they were smooth* *I then used a pillar drill to drill all the holes and sanded the hole to smooth over.*	
3	*Cordless drill*	*I used a cordless drill to drill through the syringes.*	

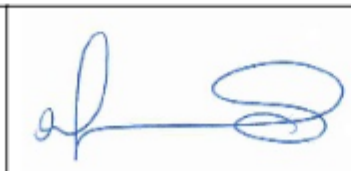
4	Wire cutters	I marked out the dowel rod pieces to assembly the excavator, each piece was marked using a pencil cut to length using wire cutters.	
5	Glue gun Wire cutters	I used a glue gun to assemble the base of the excavator to an 8mm piece of dowel for stability. I also used the glue gun to assemble the digger sections of the excavator. I assembled the MDF pieces with the syringes, cable	

FINAL MODEL

Learner Observation

Record of Learner Observation

Qualification	V.cert L1 / 2 Engineering	**Learner Name**	Stephen Thomas
Date & Time of observation	11th - 31st January 2018 (3 weeks @ 2 lessons per week - total 6 lessons)	**Assessor Name**	Laura Mulligan
Description of the learner's activity.		Assessment Criteria Met	
People present Laura Mulligan (LM- Engineering Teacher) Linda Rodgers (LR - Supporting TA - DT LSA Link) Roy Michael (RM - DT Technician - DT and H&S qualified) Dawn Maskell (DM - Head of DT Department). **What was observed** Hydraulic Arm Manufacture **What the learner did** • Marked out plywood using tri-square, pencil or laser cutter (RM) according to their engineering drawings. (LM & LR) • A tenon saw with a bench hook and vice and a coping saw with a vice to cut along the marked lines by hand and a laser cutting machine to cut the more detailed pieces. (LM & LR) • Orbital sander and a disc sander to clean up the edges of hand cut pieces (LM) • Pillar drill with a 4mm drill bit to create the holes for connecting the parts. (LM & RM) • Assembled hydraulic mechanism using glue gun for plywood to plywood, cable ties to connect the syringes to the thread rod, trimmed off with wire cutters. (LM & DM) AO4 Demonstrate and apply technical skills and processes - Band - 1 You can demonstrate and apply basic engineering technical skills by applying and using in a limited way engineering processes, tools and techniques and engineering technical skills to develop a partially complete solution/outcome		**Task 2** manufacture your functioning prototype of the hydraulic excavator to an appropriate scale of choice • Demonstrate that you are able to carry out manufacturing techniques • Set up and use a minimum of one Computer Aided Machine, one fixed machine, one power tool, one hand tool to manufacture your hydraulic excavator • Evidence how you demonstrated safe and correct use of tools and/machinery throughout the manufacturing process.	

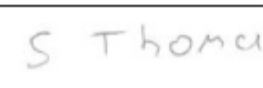
Assessor Signature		**Date**	31st January 2018
Learner Signature	S Thomas	**Date**	31st January 2018

Learner Interview

Record of Professional Discussion

Qualification	V.cert L2 Engineering	**Learner Name**	Stephen Thomas
Date and Time of discussion	02/02/2018	**Assessor Name**	Laura Mulligan

Record of the Professional Discussion.	**Assessment criteria met**
People present Laura Mulligan & Dawn Maskell **Q&A** 1. How have you demonstrated that you are able to carry out manufacturing techniques? 2. How did you set up and use a Computer Aided Machine to manufacture your hydraulic excavator? 3. How did you set up and use a fixed machine to manufacture your hydraulic excavator? 4. How did you set up and use a power tool to manufacture your hydraulic excavator? 5. How did you set up and use a hand tool to manufacture your hydraulic excavator? 6. How have you evidenced how you demonstrated safe and correct use of tools and machinery throughout the manufacturing process. **What the learner did - learner response:** 1. I have researched and used a range of tools and equipment and i tested the materials for suitability before starting. 2. I used the laser cutting machine to cut my template. 3. I used the pillar drill. and used a chuck key to insert and tighten the correct drill bit. 4. I used an orbital sander to clean up the edges and surfaces of the plywood. 5. I wore a dust mask, goggles and an apron. 6. I used a tenon saw 7. I know the location of the power cut off buttons. I wore the correct PPE and used the machine or tool safety feature where applicable.	Demonstrate that you are able to carry out manufacturing techniques Set up and use a minimum of one Computer Aided Machine,one fixed machine, one power tool, one hand tool to manufacture your hydraulic excavator Evidence how you demonstrated safe and correct use of tools and/machinery throughout the manufacturing process.
Feedback to Learner	
You have explained with a limited amount of accuracy and relevance in your discussions to demonstrate ability to describe the manufacturing processes you have undertaken. Your knowledge is of a basic and at time inconsistent standard which was evident through observation of practical application	

Assessor Signature		**Date**	02/02/2018
Learner Signature		**Date**	02/02/2018

Evaluation of the project.

I thought the materials testing was good. I think the MDf was the best material as it got good scores. This material was easy to work with and looked ok at the end. It was also the cheapest, which I why I chose it.

I found isometric drawing really hard, But I used isometric grid paper to help me. I find it hard and get confused something with which way the lines should go.

I also found the CAD really hard and had to spend a lot of my time on this. I found this to be harder than hand drawing as I had to draw in 3D for 2D drawings! Although the CAD drawings looked more professional when they were done.

I decided to do the production plan as a flow diagram to make each stage of the process clear. I thought my plan was quite accurate and I did follow this in the manufacturing stages, although I could have added more detail.

I had to get help in setting up and using the Laser cutter get the power and speed setting correct.

I set up and used the pillar drill and disc sander with help from the teacher.

I always I wore a DT apron and wore goggles

I am happy with the final outcome I think it is good for me, I think if I had had longer I might have done a bit better.

Assessor Feedback to Learner

Learner Name	Stephen Thomas	**Qualification Name**	
Assessor Name	Laura Mulligan	**Qualification Number**	

Please list the assessment objectives which were achieved

AO1 Recall knowledge and show understanding – Band - 1
Learners recall and communicate **basic** engineering knowledge and understanding.

Subject specific terminology, if used, is **basic** and **inconsistent**.

AO2 Apply knowledge and understanding – Band - 1
Learner's application of knowledge and understanding of maths, science and engineering theory is of **limited accuracy** and **relevance** to the context and situation.

AO3 Analyse and evaluate knowledge and understanding – Band - 1
Learners **respond simply** to engineering information and **provide comments**.

AO4 Demonstrate and apply technical skills and processes – Band - 1
Learners demonstrate and apply **basic** engineering technical skills by applying and using **in a limited way** engineering processes, tools and techniques.

Learners demonstrate and apply engineering technical skills to develop a **partially complete** solution/outcome

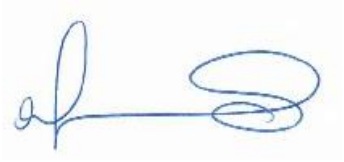
AO5 Manage and evaluate the project – Band – -2
Learners manage the project, including preparation and planning of a range of project stages, time frames and resources.

Learners evaluate some of their approaches, skills and accomplishments.

Feedback from Assessor to Learner

You have produced an assessment which simply responds to the assessment objectives across the tasks. You have demonstrated a basic understanding of engineering with a limited amount of accuracy and relevance. Your knowledge is evident in the use of more basic tools and machinery you applied in the practical element of the synoptic assignment.

Comments from Learner
I have enjoyed this project and I am happy with what I have done.

Any further actions? (Please initial and date once actions have been completed)			
Learner Signature	S Thomas	**Date**	February 2018
Assessor Signature		**Date**	February 2018

Marking Guide

/\ word missing **sp** spelling **p** punctuation **gr** grammar

ex poor expression **T** wrong tense **?** meaning unclear

Cp capital letter **//** new paragraph **!** not sure what this is—incoherent

External Quality Assurer Commentary

Grade awarded for this assessment criterion – **Level 1 Merit**

Justification for the awarded grade:

AO1 Recall knowledge and show understanding

Band – 1

The learner was able to recall and communicate **basic** engineering knowledge and understanding. There were some gaps in knowledge which were evident during conversations and observations. This can also be seen through the work submitted in the portfolio. Some tasks required guidance and prompts to support the learner, such as setting up equipment to ensure safety and this was taken into consideration in grading.

The subject specific terminology used, was **basic** and **inconsistent**. There was some use of subject specific terminology but there were a number of times when the correct terminology was not used and language was basic.

AO2 Apply knowledge and understanding

Band – 1

The learner's application of knowledge and understanding of maths, science and engineering theory is of **limited accuracy** and **relevance** to the context and situation. Use of the star profile and application of data along with measuring skills demonstrates maths and testing demonstrated science application. These could have been developed much more to aim for a higher band.

AO3 Analyse and evaluate knowledge and understanding

Band – 1

The learner **responded simply** to engineering information and **provided comments**. The learner interview required some prompts and answers were simplistic without explanation of evaluation of impact.

AO4 Demonstrate and apply technical skills and processes

Band - 1

The learner demonstrated and applied relevant engineering technical skills effectively, by applying and using appropriate engineering processes, tools and techniques. This is one of the learners stronger skillsets in engineering and it is evident they have enjoyed the manufacturing task, progress could have been more efficient. The learner demonstrated and applied **basic** engineering technical skills by applying and using **in a limited way** engineering processes, tools and techniques.

The learner demonstrated and applied engineering technical skills to develop a **partially complete** solution/outcome. The overall product was incomplete

AO5 Manage and evaluate the project

Band - 2

The learner managed the project, including preparation and planning of **a range** of project stages, time frames and resources. Planning and preparation was present and there was some good comments in the risk assessment, however there was limited depth in the planning
The Learner **provided comments** on **some of** their approaches, skills and accomplishments. There is some self-evaluation of the project, but most of this is towards the end of the project and could have been developed more ongoing.