T Level Technical Qualification in Engineering and Manufacturing – Maintenance, Installation and Repair

8712-312 Mechatronic Occupational Specialism

Grade Standard Exemplification Material

Pass - Summer 2025

Version 1.1

Version and date	Change detail	Section
v1.0 31st October 2025	First published	N/A
V1.1 24th November 2025	Amendments in relation to City & Guilds Limited	Back Cover

Contents

Introduction

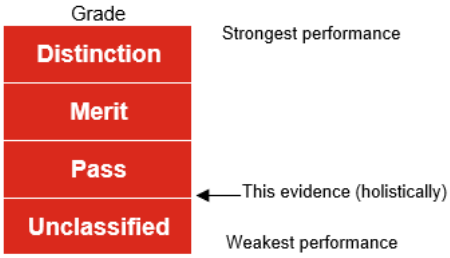
Summer 2025 Results

This document is aimed at providers and learners to help understand the standard that was required in the summer 2025 assessment series to achieve a pass grade for the 8712-312 Maintenance, Installation and Repair in Mechatronic Engineering Occupational Specialism (OS).

The Grade Standard Exemplification Material (Grade SEM) evidence provided for the pass grade displays the holistic standard required across the tasks to achieve the pass grade boundary in the summer 2025 series.

The aim of these materials is to provide examples of knowledge, skills and understanding that attested to pass standard (threshold competence) in summer 2025. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and standard of performance will vary across tasks.

The Occupational Specialism is graded Distinction, Merit, Pass or Unclassified.



The pass grade boundary is based on a synoptic mark across all tasks. The materials in this Grade SEM are separated into two sections as described below. Materials are presented against a number of tasks from the assignment.

Tasks

This section details the tasks that the candidate has been asked to carry out. What needs to be submitted for marking and any additional evidence required including any photograph/video evidence. Candidate evidence that was or was not included in this Grade SEM has also been identified within this section.

In this Grade SEM there is candidate evidence from:

Task 1 Plan and prepare the maintenance activities
Task 2 Perform and record the maintenance activities
Task 3A Review and report the maintenance activities
Task 3B Peer review
Task 4 Complete Handover

Candidate evidence

This section includes exemplars of candidate work, photographs of the work in production (or completed) and practical observation records of the assessment completed by provider assessors. This was evidence that was captured as part of the assessment and then internally marked by the provider assessor.

The Occupational Specialism brief and tasks can be downloaded from here.

Important things to note:

- We discussed the approach to standard setting/maintaining with Ofqual and the other awarding organisations before awarding this year. We have agreed to take account of the newness of qualifications in how we award this year to recognise that students and teachers are less familiar with the assessments (https://www.gov.uk/government/publications/ofqual-guide-for-schools-and-colleges-2025/ofqual-guide-for-schools-and-colleges-2025#grading), whilst also recognising the standards required for these qualifications.

- The evidence presented, as a whole, was sufficient to achieve the pass grade. However, performance across the tasks may vary (i.e. some tasks completed to a higher/lower standard than pass grade).

Grade descriptors

To achieve a pass (threshold competence), a candidate will be able to:

Interpret technical information, plan, assess risk and follow safe working methods appropriately when applying practical skills to an acceptable standard to satisfy the requirements of the brief.

Adequately prepare working areas to allow safe working, acknowledging potential risks and applying acceptable housekeeping techniques during tasks.

Demonstrate basic technical skills for maintaining, installing and repairing and diagnosing components, assemblies and sub-assemblies in line with the requirements of the brief.

Demonstrate adequate skills using tools and equipment for mechatronic maintenance, installation and repair, ensuring safe isolation, removal and replacement of components.

Demonstrate basic knowledge and understanding of the principles and processes required for disassembly, repair, configuration and reassembly of mechatronic systems, ensuring that most tolerances and tightening torques are in-line with specification.

Work safely showing an understanding and suitable level of awareness in the preparation and application of processes, selection and use of tools, equipment, materials and components for maintenance, installation and repair activities.

Mostly use industry and technical terminology accurately across different communication methods with some consideration of technical and non-technical audiences.

Task 1 Plan and prepare the maintenance activities

Assessment number (eg 1234-033)	8712-312
Assessment title	Mechatronic Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	1
Evidence title / description	A list of requirements and resources, including justifications for the selections Completed risk assessment Method Statement
Date submitted by candidate	dd/mm/yy

Task 1

Assessment themes:

- Health and safety
- Planning and preparation
- Systems and components

You must analyse the brief and technical information about the system provided and then:

- create a list of the requirements and resources for the maintenance activities, justifying your selections. This should include:
    - all necessary technical information to confirm the type, scope and requirements of the activity
    - tools and equipment
    - materials, components and consumables
    - wastage and disposal requirements
    - time needed to carry out the activity
    - fault diagnosis/detection methods to be used
    - any access requirements
- produce and complete a risk assessment
- produce a method statement.

Additional evidence of your performance that must be captured for marking:
none

Candidate evidence

Task 1 - List of required tools, PPE and requirements

Time needed to complete maintenance and diagnostic tasks – 11 hours.

TOOL	AMOUNT NEEDED	JUSTIFICATION
Full spanner set	1	Used to loosen/remove any nuts or bolts.
Philips head screwdriver	1	Used to remove any screws.
Small flathead screwdriver	1	Used when wiring components in PLC.
Wire Strippers	1	Used to strip wire before being inserted into terminals.
Snippers	1	Hold wire in position when tightening terminals.
Laptop/Cables	1	Used to access PLC software and diagnose any issues.
Tenth/Bivvy	1	Used to cover laptop and plc wiring in case of rainfall.
Full Allen-key set	1	Loosen any awkward nuts.
Soldering Set	1	To repair any broken or faulty solders.
Wire Cutters	1	Used to cut/trim any wire.
Spare Wire	As needed	Used to replace any old/broken wiring.
Multimeter	1	Used to check resistance within the system.
Bin	1	Used to discard of any old/broken wires and any waste.
Solder Extractor Fan	1	Used to extract possibly harmful fumes from burning solder.

Mallet	1	Used to gently realign components.
PPE	AMOUNT NEEDED	JUSTIFICATION
Safety Glasses	1	Stop any stray wire hitting your eyes.
Rubber Gloves	1	Protect against electrical current, also protects hands from sharp wire.
Steel-capped Boots	1	Protect your feet from heavy equipment.
High-Vis Jacket	1	Used to make public aware of you.
Hard Hat	1	Protect against damage to the head from barrier or other components.
Mask/Respirator	1	Extra Safety when soldering.
Appropriate work Clothing	As needed	Stop any loose clothing getting stuck within the system.

Task 1 – Risk Assessment

Date:	Name: <candidate>	H&S Representative: <candidate>		Location: Car Park			
NO.	**HAZARD**	**PERSON AFFECTED**	**LIKELYHOOD**	**SEVERITY**	**RISK LEVEL**	**CONTROL MEASURES**	**ADDITIONAL CONTROL MEASURES**
1	Tripping Over	S, W, A, YP, PW, Tr, T, V	2	2	2	Always make sure floor is clean and no trip hazards.	Add signage or barriers to make it known it is under maintenance. Bin always accessible. Brush always accessible.
2	Electrical Shock	S, W, A, YP, PW, Tr, T, V	2	3	3	Always wear correct PPE, Isolate systems before maintenance	Use multimeter to ensure no current is flowing through the system.
3	Barrier Falls	S, W, A, YP, PW, Tr, T, V	1	5	4	Always be aware of the position of the barrier, always wear correct PPE	Never stand directly under unless performing essential maintanence. Add softer material to bottom of barrier.
4	Burn from Solder	S, W, A, YP, PW, Tr, T, V	2	3	3	Always wear correct PPE when soldering.	Make sure extractor fan is on when soldering. Always wear ruber gloves mask and goggles.
5	Sickness from solder fumes	S, W, A, YP, PW, Tr, T, V	2	4	4	Always wear appropriate mask/respirator	Make sure extractor fan is on when soldering. Always wear ruber gloves mask and goggles.
6	Car trying to access site	S, W, A, YP, PW, Tr, T, V	1	2	2	Use essential barriers and signage to block off the site	Create diversion so cars know not to enter or try to enter. Use traffic cones to block entry.
7	Rainfall	S, W, A, YP, PW, Tr, T, V	2	1	1	Use of a tent/bivvy to cover eletrical systems from any water damage	Only conduct electrical maintanence if there are no signs of rainfall. Wait until rain stops.

Persons Affected: Staff (S), Workers (W), Apprentices (A), Young Persons (YP), Pregnant Worker (PW), Trainee (Tr), Trespasser (T), Visitor (V)

LIKELYHOO	SEVERITY	RISK
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5

RED = UPDATED

Task 1 – Method Statement

Pre-Maintenance:

To begin with, I will corner off the barrier system to make the public aware that maintenance is being carried out. To do so, I will erect multiple barriers that block the space off and I will use the appropriate signage needed to let people know it is not safe to enter the site without the correct training and PPE. Afterwards, I will make sure I am complying with relevant HASAWA (1974) legislations and standards by double checking that I am wearing the correct PPE before I conduct any maintenance; this should include: a pair of safety glasses to ensure my eyes are safe from any stray wire or other possible hazards, a pair of thick rubber electrical gloves to ensure that no electricity can be passed through my body when working on the system, durable steel-capped boots to ensure my feet are safe from heavy tools and machinery in case anything drops or falls, a bright high-vis jacket to let the public know where I am and where to stay clear of, a hard hat to ensure my head is safe against the barrier failing and dropping on my head when working, a mask/respirator to use when repairing any solders if needed and appropriate work clothing like cargo work pants to store extra nuts, bolts or screws and a shirt/jumper with no long strings or anything that may get caught within the system. I will put up a tent/bivvy to keep out any potential rainfall that might occur. This will eliminate any electrical damage and electrical shocks when working with components. Furthermore, I will conduct a risk assessment of the site to ensure all hazards are known to workers and preventative measures are put in place to ensure the safety of all parties.

During Maintenance:

Initially, I will set up my laptop and connect to the relevant PLC software system. I will double check that the PLC system is running on the correct updated version ensuring that everything can work uniformly without any bottlenecks from software updates. From here, I will vigorously check each ladder logic table to ensure all steps are in the correct place and nothing has been left out. After this, I will check the internal speed of the motor controller to make sure it is not running at a speed too high that the PLC cannot run effectively causing the barrier arm to malfunction. If all of this is correct and looking good, I will investigate the internal tags and addresses of the system and check that they match to the actual inputs/outputs of the PLC. If they are not the same, I will either physically rewire the PLC so that they do match, or I will internally change the tags and addresses. Following these basic checks, I will begin a practice run of the system to see if the changes I have made have fixed the system or not. Based off the assignment brief, I know that the issue with the system is something to do with the barrier arm. Because of this, I will physically check with a set off spanners and screwdrivers that the nuts and bolts connecting the barrier are at the correct tightness used to move the arm. Afterwards, I plan on checking all connections to the motor controller (wire connections, nuts, bolts and screws) are in perfect order. I will check the

actual motor itself is working and not freezing up when a car approaches. If the motor controller is broken, I will carry out the maintenance needed to fix it. If not, however, I will move onto checking the systems sensors that detect when a car is approaching the barrier. To do so, I will utilise both physical and electronic checks to see if the sensors are working. First, I will activate the sensor by acting as a car going past it, I will then look within the PLC software to see if it is working properly or not. I will then check the physical sensor itself for any damage – corrosion, rust, anything blocking the sensor, loose wires or broken wires. Depending on what is wrong, I will meticulously clean the sensor of any debris, check, remove and replace any faulty wires that could be affecting the sensors' reliability. In addition, I will then check that the sensor is programmed correctly in the PLC. This will include, checking the tags and addresses are correct, make sure the sensor block is in the correct place in the ladder logic making sure it is directly linked to the barrier and looping feedback efficiently. I will also check that the camshaft that raises the barrier based on the sensor's information is in working order. I will check that it spins 180 degrees clockwise and counterclockwise depending on whether it is going up or down. If the camshaft is not doing this correctly and is only spinning 160 degrees clockwise, for example, it may be the reason for the barrier not lifting. If this is the case, I will have to reconfigure the camshaft within the PLC system to ensure that it is spinning in the right direction at the right angle at the right time. I will also check for any damaged parts within the barrier like seized bearings for example. If I find any broken or damaged components I will promptly replace/repair them as they need doing. I will then run another test to ensure everything works as it should.

Post maintenance:

Once I have completely checked the system for any faults and I have made the repairs I see fit, will conduct a final practice run of the barrier system to ensure that everything is working how it should and there are no faults anywhere. If everything is in working order, I can begin packing away everything I used to conduct maintenance e.g. spanners, screwdrivers, snippers and wire cutters. I will also disconnect my laptop from the PLC system ensuring I saved any changes I made to the software. I will then remove all barriers and signage I put up reopening the site to public use. Finally, I will complete a technical report of all the maintenance I had to conduct on the system, going into extreme detail so that the next person who conducts maintenance knows where to start and knows the history of the system.

Task 2 Perform and record the maintenance activities

Assessment number (eg 1234-033)	8712-312
Assessment title	Mechatronic Occupational Specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	2
Evidence title / description	Practical observation form Photographic evidence
Date submitted by candidate	dd/mm/yy

Task 2

Assessment themes:

- Health and safety
- Planning and preparation
- Systems and components
- Working with faults
- Reviewing and reporting

You must:

- prepare the work area for the maintenance activities
- perform the maintenance activities in accordance with the method statement and planning documents produced in Task 1. This should include:
    - decommissioning and inspection of the system
    - disassembly and reassembly of the system
    - diagnosing, and recording faults within the system, including carrying out appropriate tests
    - repairing the faults and replacing components as required
    - safely using the appropriate tools and equipment
    - recommissioning of the system
    - demonstration of system functionality to your supervisor
    - re-instating the work area
- record the maintenance activities, to include:
    - producing and completing test record sheets
    - updated maintenance records and control documents
    - annotating the method statement, including any recommendations for further investigation if required.

Additional evidence of your performance that must be captured for marking:

- assessor observations:
    - of the work area preparation
    - of the maintenance activities
    - of the system functionality demonstration.
- photographic evidence which shows:
    - the prepared work area
    - the work area after disassembly
    - the refitted components follow fault rectification (where applicable)
    - the re-instated work area.

Candidate evidence

Task 2 - Practical observation form

8712-312 Maintenance Engineering Technologies: Mechatronic - Summer 2025

Candidate Name	Candidate number
<candidate>	ABC1234
Provider name	**Date**
<provider>	04/04/2025

Complete the table below referring to the relevant marking grid, found in the assessment pack.

Do not allocate marks at this stage.

This observation must cover	Assessor observation should include:	Assessment Themes
Work area preparation	• The work area preparation.	• Health and Safety • Planning and Preparation • Systems and Components
Maintenance activities	• decommissioning and inspection of the system • disassembly and reassembly of the system • diagnosis and recording of faults within the system, including carrying out appropriate tests • repairing the faults and replacing components as required • use of tools and equipment • recommissioning of the system • demonstration of system functionality to the supervisor • re-instating the work area.	• Health and Safety • Planning and Preparation • Systems and Components

Notes – *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*

Work area preparation:

The candidate entered the workshop and, after assessing the work area, cleared the area of debris and swept the floors to allow some work to be caried out. However, a stillage had not been moved from the rear of the work bench, allowing access to only one side of the system.

The candidate's risk assessment covers the majority of risk factors and some control measures have been identified. However, the information given is very basic. Likelihood or severity has been considered for risks and hazards.

Some relevant potential safety issues were considered, such as Personal Protective Equipment (PPE) selection and work area set up, as part of preparatory checks and planning activities, even taking the possibility for bad weather into consideration. Unfortunately, no isolation procedures were mentioned.

There was no analysis of any technical documentation relevant to the system. These documents were not requested nor read. This means some factors appropriate to the brief were covered in limited detail.

The candidate's method statement shows some consideration of scope, processes, tools and equipment, but is not in a logical sequence making it a little difficult to follow; for example, stating "I will physically check with a set off spanners and screwdrivers that the nuts and bolts connecting the barrier are at the correct tightness used to move the arm". This statement does not use technical terminology, nor does it list the correct tools to be used. The candidate did wear appropriate PPE as listed in their method statement.

No technical data sheets, operation manuals or user guides were mentioned by the candidate. Some resources and requirements for the Programmable Logic Controller (PLC) were mentioned, including some relevant technical documentation, but with limited justifications.

The candidate listed a limited range of materials, components and resources. They demonstrated minimal consideration for the condition, quality and performance of tools and equipment by choosing equipment without checking the working condition or serviceability. All tools mentioned had basic justifications given.

The work area was prepared with some consideration of the prepared method statement and workflow. However, improvements were only made half way through the work being carried out when the candidate realised a stillage was in the way and they had to stop working to remove the item to allow access.

No technical information or data sheets were requested or used (See images 19,23,25,37,38)

Maintenance activities:

- decommissioning and inspection of the system
- disassembly and reassembly of the system
- diagnosis and recording of faults within the system, including carrying out appropriate tests

- repairing the faults and replacing components as required
- use of tools and equipment
- recommissioning of the system
- demonstration of system functionality to the supervisor
- re-instating the work area.

No Lockout-Tagout (LOTO) procedures were carried out when testing the system. The system was unplugged but the correct isolation steps were not followed. There was no testing of equipment safety or any calibration carried out.

The candidate demonstrated some understanding and application of inspection and testing methods through work being carried out and completed. They used suitable test and measurement equipment to judge the time operations. Clear interpretation and application of some parameters and tolerances were checked. Most units of measurement and calculations were used appropriately with some accuracy.

Some outputs, data and readings were compared with the operation of the equipment; however, discrepancies were not always identified. This meant that the candidate needing to carry out many operations to figure out that the motor controller was set up incorrectly. They appeared to be working with a system of repeatedly making a change and then trying the equipment to see if it worked. The candidate followed some recording procedures. (See images 5,8,7,9,17)

Disassembly and reassembly procedures (including decommissioning, commissioning and return to service) were carried out with some levels of accuracy and efficiency. The candidate demonstrated that some correct steps of stripping out were followed. They struggled with alignment of the axles when recommissioning. Some measurements were taken to ensure reliability and durability but not always accurately.

The candidate used some relevant tools and equipment adequately, including expert technologies such as PLC programme, ladder logic and trace functions, throughout disassembly and reassembly activities, but with limited consideration for accuracy. There were some occasions when the barrier was moving or attempting to move unexpectedly.

The candidate used a screwdriver and hammer to remove a bearing from its housing. They then refitted the bearing with a claw hammer with no care for inner or outer race damage (See images 16,18,26,27,28,41,42).

Fault detection and diagnostic techniques were carried out with some success, demonstrating good understanding and application of fault finding with only minor inaccuracies. All four faults were correctly diagnosed using a range of fully appropriate fault detection and diagnostic techniques performed accurately.

Some diagnostic and measurement information were used to determine the causes of the faults, such as visual inspections to detect loose wires and operational tests to check alignment. The candidate created a limited schedule of tasks for reactive and preventative maintenance activities (See image 34).

The candidate used some accurate resolution methods. Some methods used such as the removal of a bearing with a hammer and screwdriver were effective but not correct or accurate. There was minimal reference to manufacturer’s specifications. There were no torque settings

taken into consideration and minimal alignment measurements taken. The candidate demonstrated brief consideration of recording procedures. All four faults were repaired to an operational standard within the timeframe.

Internal assessor signature	Date
X	dd/mm/yy

If completing electronically, double-click next to the 'X' to add an electronic signature once the record is **finalised**.

Task 2 – Photographic evidence

Image 1

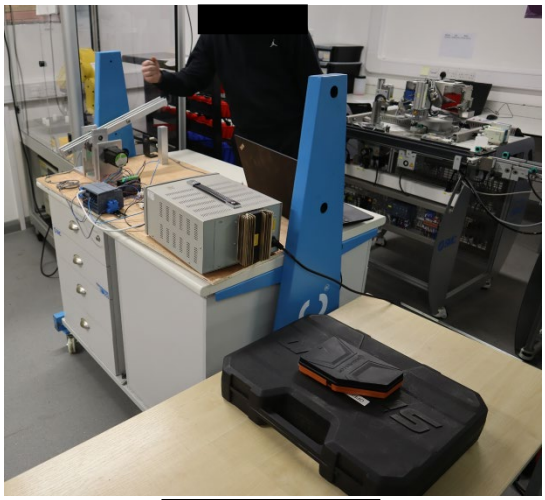
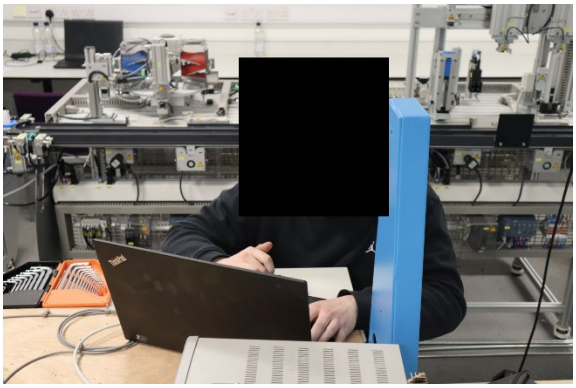


Image 2

Image 3

Image 4



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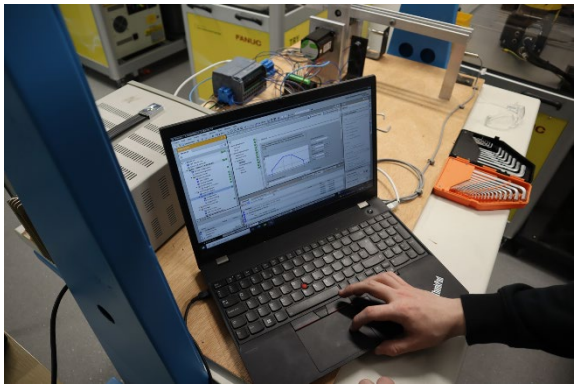

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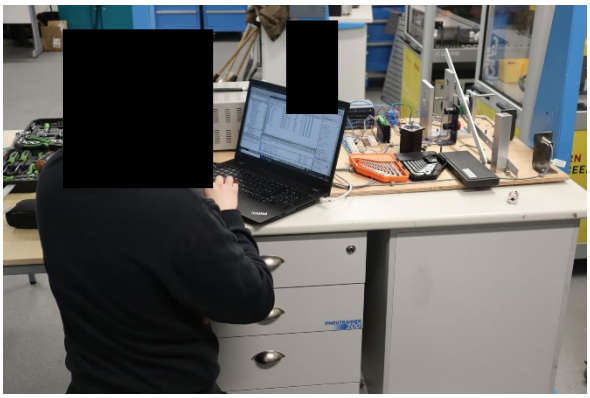

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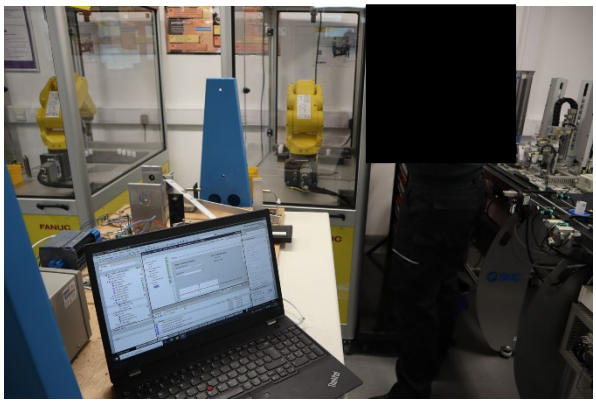

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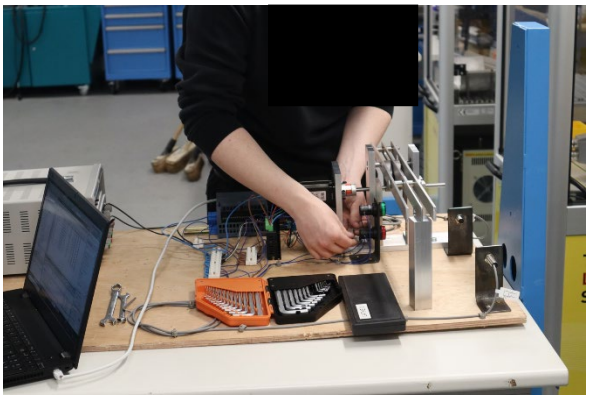
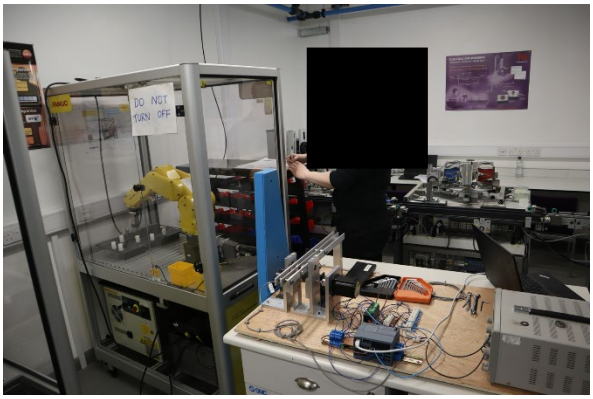


Image 9

Image 10



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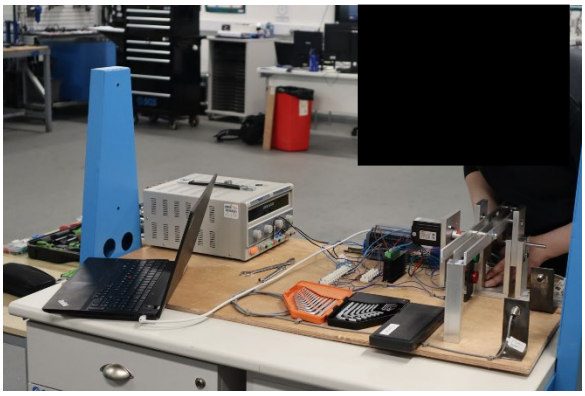

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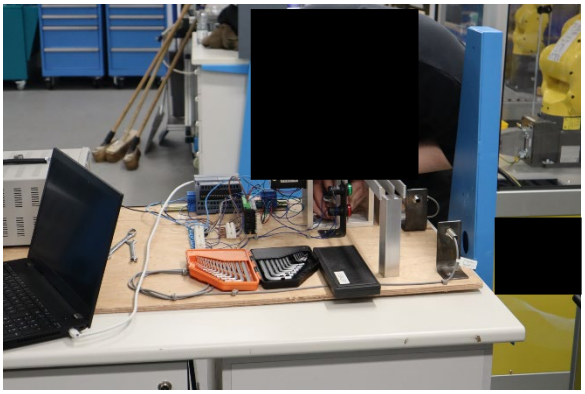

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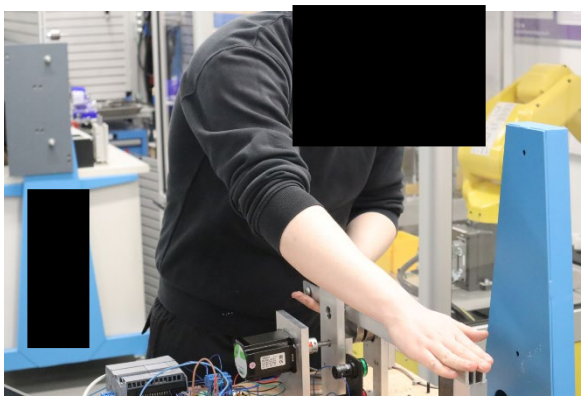

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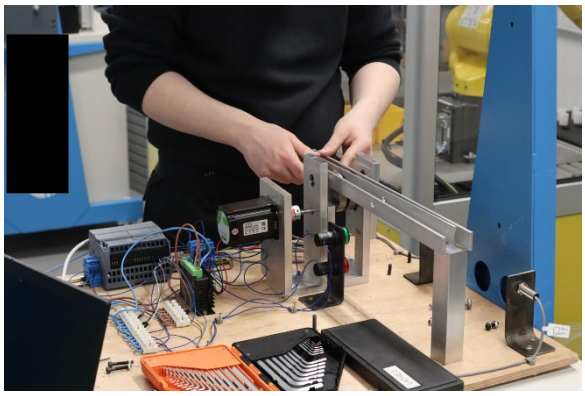

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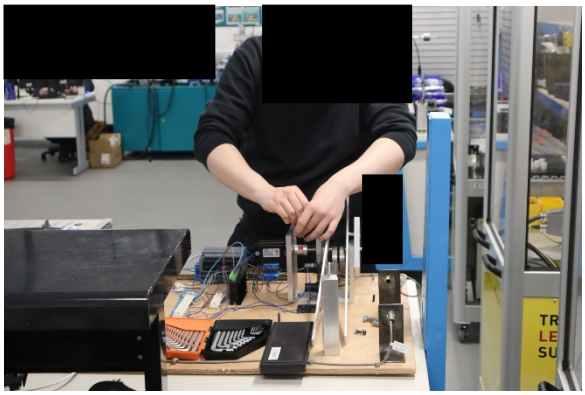

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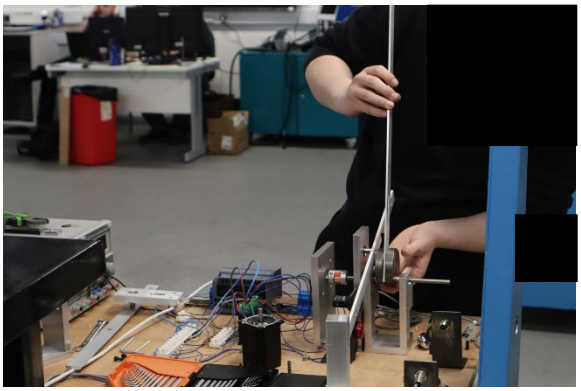

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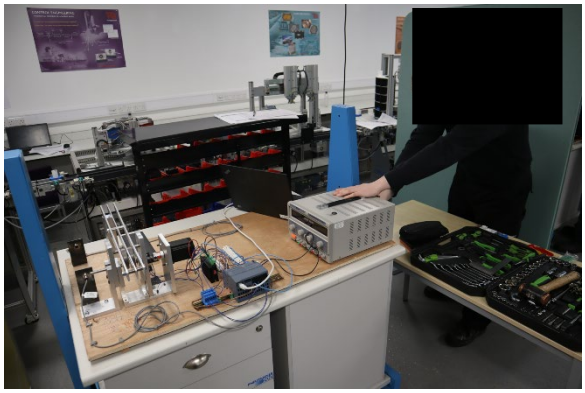

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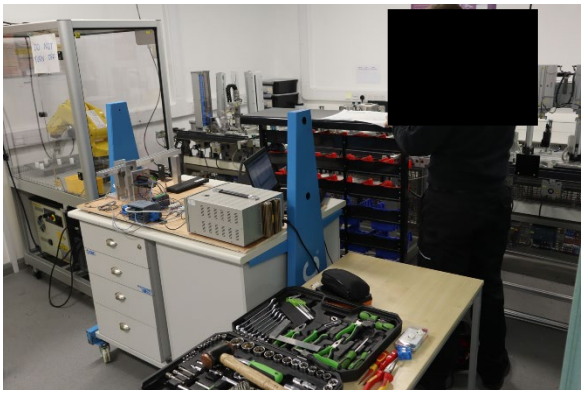

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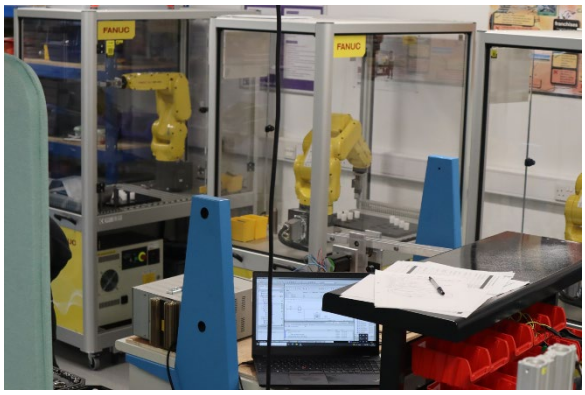

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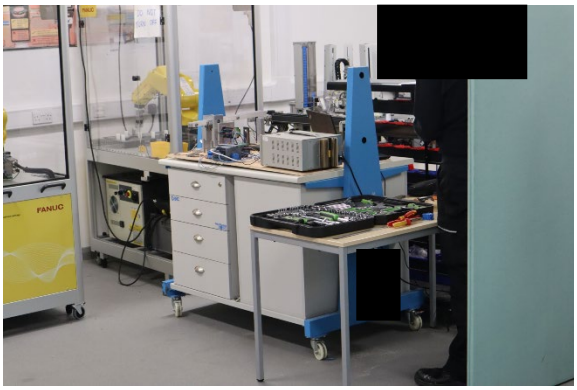


Image 21

Image 22

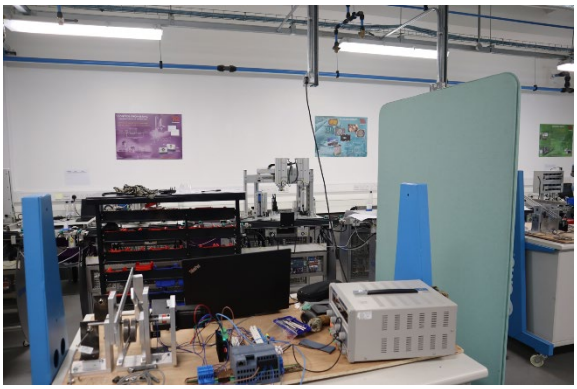
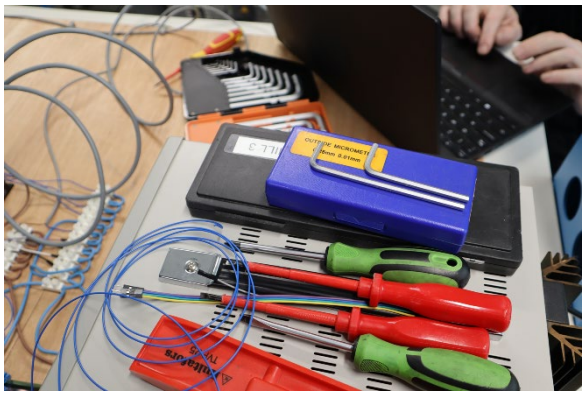


Image 23



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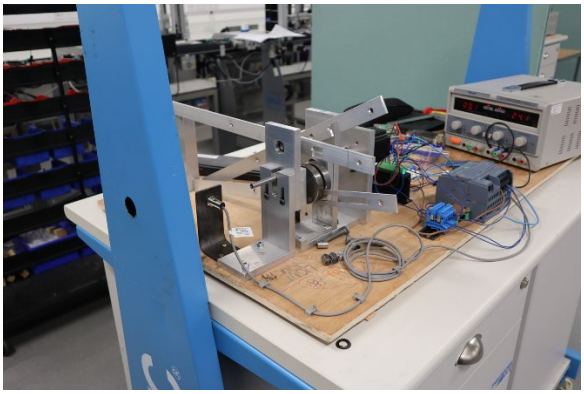

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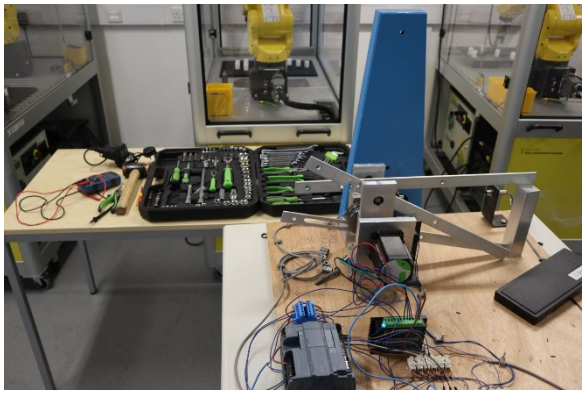

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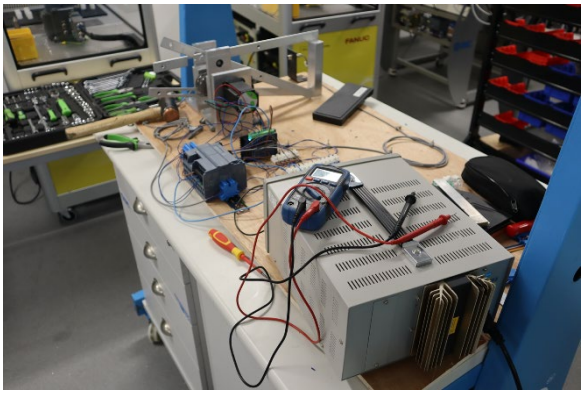

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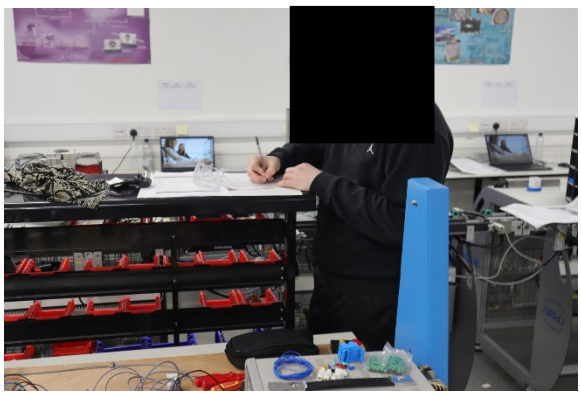

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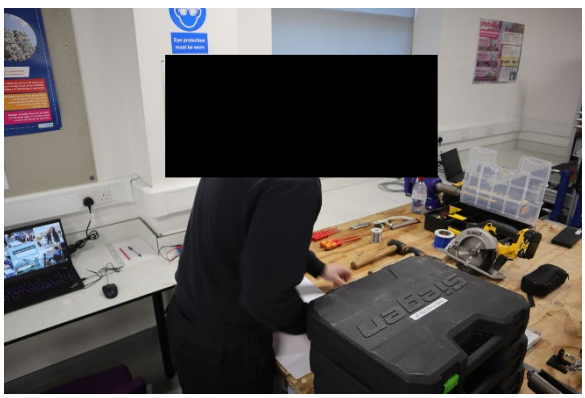

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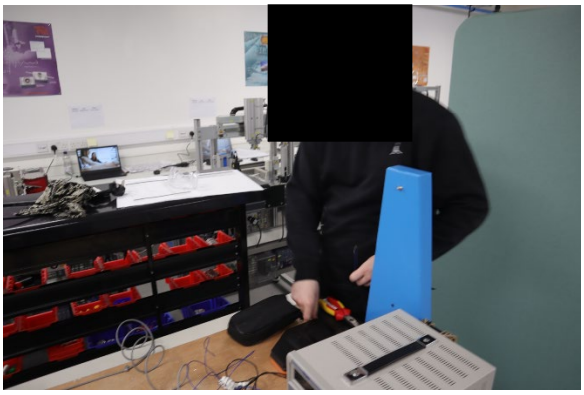

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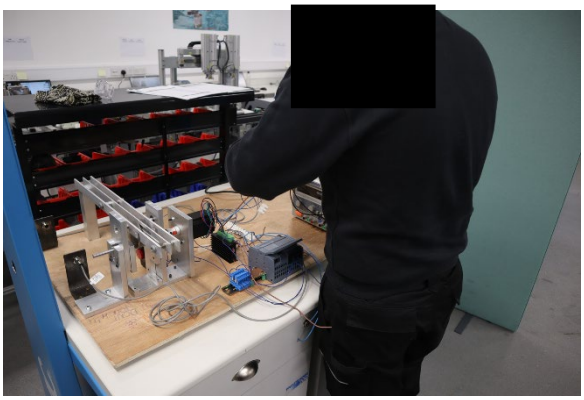

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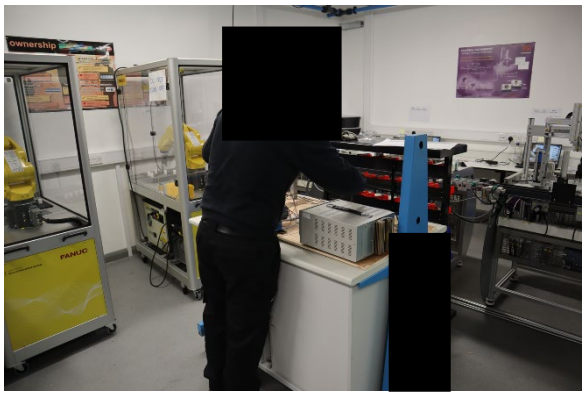

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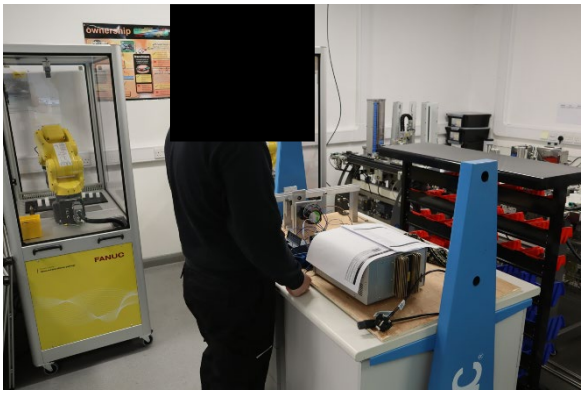

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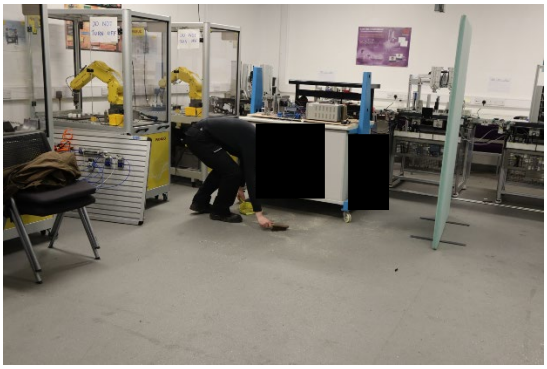

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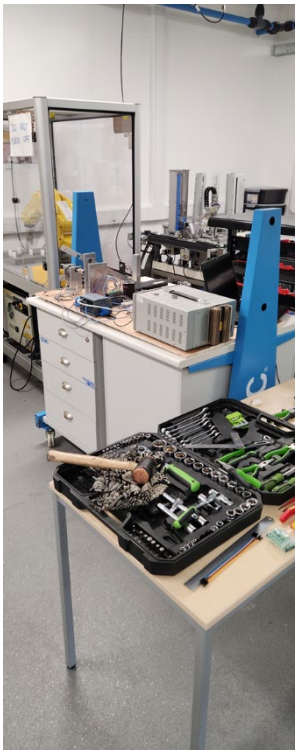

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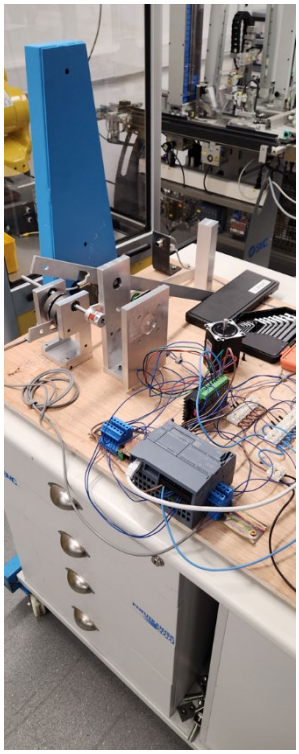

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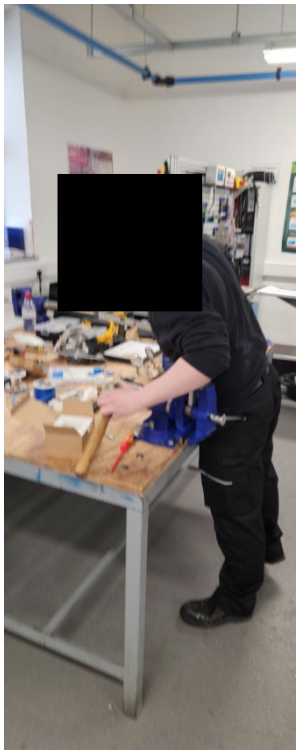

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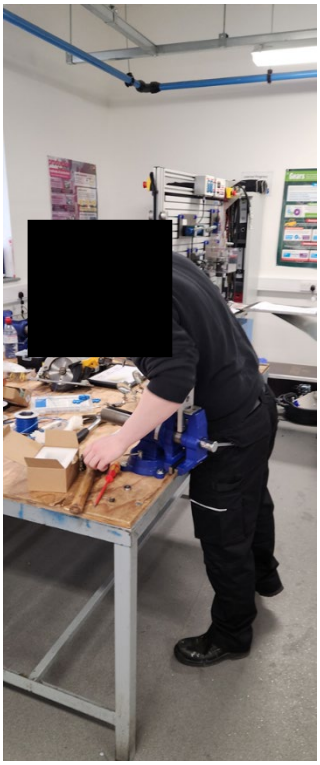

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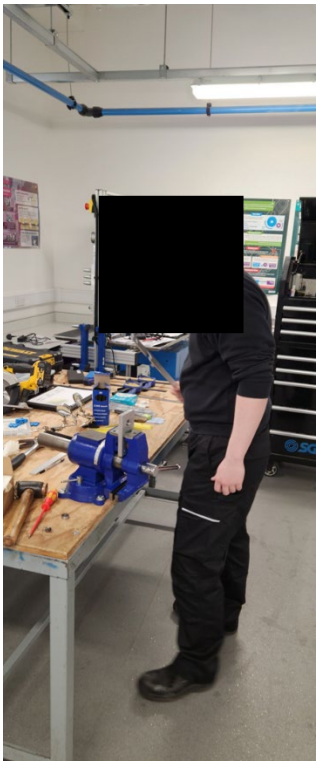

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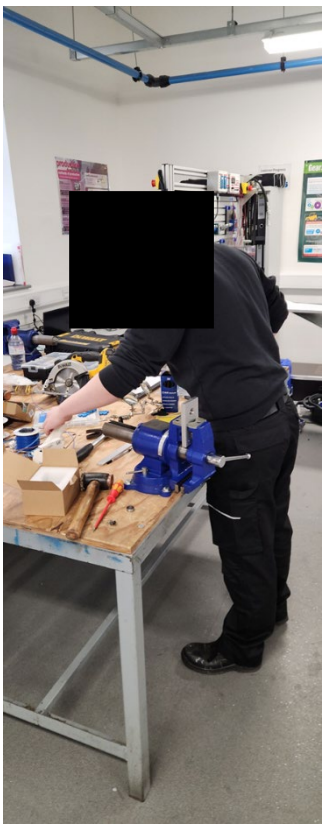

Image 44

Image 45

Task 3a Review and report the maintenance activities

Assessment number (eg 1234-033)	8712-312
Assessment title	Mechatronic Occupational specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3a
Evidence title / description	Technical Report Revised maintenance schedule, including justifications
Date submitted by candidate	dd/mm/yy

Task 3a

Assessment themes:

- Health and safety
- Systems and components
- Reviewing and reporting

You must:

- produce a technical report for the supervisor. This should typically be 850 words and include:
    - a review of the maintenance activities, including fault diagnosis/detection techniques and suggestions for future improvements
    - the faults found and how they were rectified
    - any outstanding faults, including recommendations that may require attention before the next planned maintenance activity according to the current maintenance schedule
    - reporting of stock levels and waste disposal
- produce a revised maintenance schedule from your activities and findings, this should include:
    - recommendations for future planned maintenance, including justifications
    - due date of next maintenance activity.

Additional evidence of your performance that must be captured for marking:
none.

Candidate evidence

Task 3a – Technical Report

Introduction.

This technical report is based on the recent maintenance of the car barrier system. It will cover the faults found, the implications used to rectify each fault and recommended maintenance activities for the future. Furthermore, it will include the actions taken to manage waste control and how waste was properly disposed.

Maintenance Overview.

Firstly, all wired connections to the PLC, the Motor, the live/neutral blocks, the power supply and motor controller were checked. This basic first check eliminates the possibility of components not working because of loose wires. This also can prevent conducting maintenance on components that don't need fixing. Secondly, the mechanical system was checked over entirely, which consisted of checking for seized bearings, checking the CAM wasn't broken or stuck, nuts, bolts and screws were tight enough but not too tight, checking the barrier arm for any damage or wear and checking all other connecting parts/metal components were not damaged or worn away. Next, I checked the PLC itself was working correctly; I restarted it and diagnosed there was no immediate software issues but issues within individual component settings.

Fault Diagnosis and Rectification.

Fault 1 – The first fault I found was a bearing that is located on the left-hand side mount had seized up. Because of this, the axel that rotates causing the barrier to move was not working properly. The motor would try and move but the bearing would lock it into place creating a 'cracking' sound and causing the system to jerk.

Rectification 1 – To fix this, I removed the mount the bearing is held in from the system and placed it to one side. I then disconnected the part of the barrier arm attached to the bearing and began work. I placed the mount into a vyse and used a hammer and a screwdriver the knock the bearing out. Afterwards, I used the hammer to put a new bearing into the mount.

Fault 2 – The next fault I found was on the motor controller. The motor controller is connected directly to the PLC, and it is what tells the motor how fast or slow to rotate. In this case, settings on the motor controller did not match up with the settings for the motor on the PLC software. This meant that the switches on the side of the controller were either switched in the wrong positions or not switched at all. This caused the motor to spin at a rate way faster than needed.

Rectification 2 – To fix this, I went into the motor software on the PLC and found out what rate the motor was supposed to be rotating at. The motors correct rate was 500 revolutions

per second and the motor controller was set to 200. I then switched the correct switches to match the output of 500 revolutions. To do this, there is a table on the top of the controller with the number of resolutions followed by the combination of switches. For example, for 200 revolutions the combination would be On Off Off.

Fault 3 – After checking the motor software in the PLC I noticed that some settings on the motor were wrong: the minimum and maximum pulses on the motor were set to 180,000, the distance was set to 700 and velocity was 700 too. The motor used in the system is not powerful enough to exert 180,000 revolutions at a velocity of 700 so, when the sensor was tripped and the motor tried to move, it would jerk uncontrollably as it could not move fast enough.

Rectification 3 –I resolved this issue by changing the minimum and maximum revolutions to match the motor controller at 500rpm. I also changed the motor velocity and distance to 150 from 700 so that it travelled 90 degrees in a smooth and controlled manor.

Fault 4 – I then checked the PLC ladder logic for the system to ensure that all tags, addresses, inputs and outputs were correct. In doing this, I found that the tags used for the input senor and motor were wrong. The input sensor was using the wrong kind of terminal: it was using a normally closed gate which meant that when triggered the sensor wasn't detecting the number of cars coming into the car park accurately but rather detecting 1 car coming in as 10 cars. I changed this gate to a normally open and changed the detection of cars incoming from 10 at once to 1. Next, I noticed that the motor itself was programmed as an input device when it should be an output. To change this, I changed the address of the motor from an i to a Q.

Fault 4 – After checking the system over for the last time, I noticed that the barrier arm itself was not sitting correctly. The right side of the barrier was higher than the left. This meant that the alignment of the barrier was wrong.

Rectification 4 – To properly align the barrier, I had to use a size 4 allen key and loosen the bolds holding the mount in place. I then adjusted the mount on the left to match the height of the fixed barrier mount. I made sure they were perfectly in line then tightened the mount back into position.

Stock and waste Disposal.

The only waste generated when conducting maintenance on this system was the seized bearing that had to be replaced. This bearing was put into the correct metal bin designed for old metal parts and metallic scraps. This is to ensure the proper disposal of the metal component and to ensure that it did not end up in the wrong bin potentially causing harm to someone who may encounter it. Before maintenance, the area surrounding the system was cleaned: this included sweeping the floor for any trip hazards, dirt and clearing away any unwanted tools or consumables. The waste from the floor and surrounding areas was put into an environmental bin ensuring that it reaches the correct place for processing. As for

stock, all the tools needed were safely kept out the way of the system on a separate table along with my laptop and laptop wires. The tools on the table included: a hammer, an Allen Key set, terminal screwdrivers (Phillips head and flat head) and normal screw drivers (Phillips head and flat head). I made sure to keep them far from the edge with no overhangs to eliminate the risk of them falling off and landing on someone's foot or leg.

Conclusion.

In conclusion, the maintenance activity conducted was a success and the system went from not working at all back to fully functioning. The maintenance conducted in this inspection should be checked again at the next routine maintenance check. This should include checks on bearings, alignment of barrier arm mounts, check that the motor controller is on the correct settings (check by reading table on top of controller and changing switches), check that the motor is set to the correct amount of pulses for second (this can range anywhere between 200-800 pulses) and checking that each component of the system has the correct name, address, input and output. All waste generated from maintenance of the system should be disposed of correctly using the correct bins and other methods of disposal. Your tools and stock of items should be clean and tidy and away from the system to minimise any potential risks or hazards.

Task 3a – Maintenance Schedule and Records

Equipment/System type	Identification No.
Car park barrier system	8712-312
Brand/Model	**Location**
City & Guilds	Workshop

Equipment/Specification
• the car park holds a maximum of 10 cars at any one time • when a car approaches the car park barrier, a light emitting diode (LED) will be illuminated • a green LED (D2) will illuminate if there are spaces in the car park and the car will be permitted to enter the car park • a red LED (D1) will illuminate if there are no spaces in the car park and the car will not be permitted to enter the car park • when a car approaches the car park barrier the car is detected by S1 • a signal is then sent from S1 to the Programmable Logic Controller (PLC) • PLC checks the internal counter if there are spaces available in the car park • if there are available spaces in the car park, the PLC will send a signal to the motor controller • the motor controller (MC) then sends a signal to the stepper motor (M1) • the stepper motor rotates to turn the cam • the cam will then rotate anti-clockwise 180 degrees, as the cam rotates the lever (car park barrier arm) (A1) is smoothly raised from its horizontal starting position to a vertical 90 degrees open position • if the car park is full (10 cars) the PLC will send a signal to illuminate D1

- if there are no available spaces in the car park, a signal will not be sent to the motor controller and the car park barrier arm will not raise up
- when a car is permitted entry to the car park, S2 will detect when the car has passed the lever (car park barrier arm) to prevent the lever (car park barrier arm) lowering while a car passes underneath
- S2 will send a signal to the PLC which will then update the internal counter
- the PLC will then send a signal to the motor controller
- the motor controller then sends a signal to the stepper motor, which will then rotate the cam (CM)
- the cam will then rotate clockwise 180 degrees, as the cam rotates the car park barrier arm is smoothly lowered and the car park barrier arm returns to its horizontal starting position.

Maintenance records

Service No	Maintenance date	Maintenance type (scheduled/routine, fault/repair)	Checked by	Repair details (where relevant)	Maintenance Engineer - signature
01	20/4/2023	routine	XX	• no faults or repairs required. • system functionality as per specification.	XX
02	28/5/2024	scheduled/routine and fault/repair	XX	• lubrication of groove/slot for connector pin required • wear seen on connector pin from cam to groove/slot – replaced pin • lever not fully returning to start position - calibration of motor required. • car park barrier arm not raising when car approaching - sensor S1 replaced	XX

03	04/04/2025	Annual/reactive	XX	• Bearing seized up. • Motor controller set up incorrectly. • Motor set up incorrectly within PLC software. • Tags and addresses of motor and Input sensor wrong.	<candidate>
04					
05					
06					

Maintenance Schedule – annual unless specified otherwise					
Service No	Year	Detail inspection	Recommended planned maintenance	Maintenance Head Engineer signature	Maintenance Engineer signature
01	2023	Annual	Annual - routine/scheduled	XX	XX
02	2024	Annual	Annual - routine/scheduled	XX	XX
03	2025	Annual	Annual - routine/scheduled	XX	<candidate>

04	2026	Annual	Annual – routine/scheduled	XX	
05					
06					

Commentary	
Service No	Recommendations for future maintenance activity
03	Lubricate system before running. Replace any wires that look damaged or worn. Replace pins that connect barrier arm to bearings and the mount system.

Task 3b Peer review

Assessment number (eg 1234-033)	8712-312
Assessment title	Mechatronic Occupational specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	3b
Evidence title / description	Peer Review Form Risk assessment amended from peer review feedback, including justifications
Date submitted by candidate	dd/mm/yy

Task 3b

Assessment themes:

- Health and safety
- Systems and components
- Reviewing and reporting

You must:

- carry out a peer review on risk assessments provided by the assessor. You must consider the following:
    - *how well does the risk assessment enable maintenance activities to be performed?*
    - *how appropriate is the risk assessment and why?*
    - *what are the implications to the business of the proposed risk assessment?*
    - *how could the risk assessment be optimised/improved?*
- write up feedback for each of the risk assessment produced by other candidates on separate peer review forms
- update your own risk assessment following feedback from the peer review. Any updates need to include justifications for these changes and any changes not made will be reviewed in the handover.

Additional evidence of your performance that must be captured for marking:
none.

Candidate Evidence

Task 3b - Peer Review Form

Assessment ID	Qualification number
MIR Mechatronic Occupational Specialism	8712-312
Candidate name	**Candidate number**
xxx	xxx
Provider name	**Provider number**
xxx	xxx
Date	**Series**
April 2025	Summer 2025

Question	Feedback
How well does the risk assessment enable maintenance activities to be performed?	Choice of hazards is adequate. Persons affected is adequate other than for ‘rainfall’. I do however feel that if this was given as a risk assessment, there would not be enough information on control measures.
How appropriate is the risk assessment and why?	The risk assessment is definately appropriate and relates to the task well. The prevention/control measures described show strong links to their correlating hazards.
What are the implications to the business of the proposed risk assessment?	Not stating to check your PPE aswell as wear it could result in (in the case of an accident) a person saying: “You didn’t say I had to check it, so it should have been employers responsibility.”
How could the risk assessment be optimised/ improved?	Add an ‘additiona control measures’ section. I would also not rely solely on colours to indicate ‘risk level’; using a number value will make the document more digestable and avoid misunderstandings if the document is mono print (like now) (Add info on the date, your name, HS rep, and location of the activity)

Task 3b – Revised Risk Assessment

Date:	Name: <candidate>	H&S Representative: <candidate>	Location: Car Park				
NO.	HAZARD	PERSON AFFECTED	LIKELYHOOD	SEVERITY	RISK LEVEL	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES
1	Tripping Over	S, W, A, YP, PW, Tr, T, V	2	2	2	Always make sure floor is clean and no trip hazards.	Add signage or barriers to make it known it is under maintenance. Bin always accessible. Brush always accessible.
2	Electrical Shock	S, W, A, YP, PW, Tr, T, V	2	3	3	Always wear correct PPE, Isolate systems before maintenance	Use multimeter to ensure no current is flowing through the system.
3	Barrier Falls	S, W, A, YP, PW, Tr, T, V	1	5	4	Always be aware of the position of the barrier, always wear correct PPE	Never stand directly under unless performing essential maintanence. Add softer material to bottom of barrier.
4	Burn from Solder	S, W, A, YP, PW, Tr, T, V	2	3	3	Always wear correct PPE when soldering.	Make sure extractor fan is on when soldering. Always wear ruber gloves mask and goggles.
5	Sickness from solder fumes	S, W, A, YP, PW, Tr, T, V	2	4	4	Always wear appropriate mask/respirator	Make sure extractor fan is on when soldering. Always wear ruber gloves mask and goggles.
6	Car trying to access site	S, W, A, YP, PW, Tr, T, V	1	2	2	Use essential barriers and signage to block off the site	Create diversion so cars know not to enter or try to enter. Use traffic cones to block entry.
7	Rainfall	S, W, A, YP, PW, Tr, T, V	2	1	1	Use of a tent/bivvy to cover eletrical systems from any water damage	Only conduct electrical maintanence if there are no signs of rainfall. Wait until rain stops.

Persons Affected: Staff (S), Workers (W), Apprentices (A), Young Persons (YP), Pregnant Worker (PW), Trainee (Tr), Trespasser (T), Visitor (V)

LIKELYHOOD	SEVERITY	RISK
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5

RED = UPDATED

Task 4 Complete Handover

Assessment number (eg 1234-033)	8712-312
Assessment title	Mechatronic Occupational specialism

Candidate name	<first name> <surname>
City & Guilds candidate No.	ABC1234

Provider name	<provider name>
City & Guilds provider No.	999999a

Task(s)	4
Evidence title / description	Practical observation form
Date submitted by candidate	dd/mm/yy

Task 4

Assessment themes:

- Health and safety
- Reviewing and reporting

You must now hold a meeting with the line manager to return to service and complete handover procedures, including:

- confirmation of work completed
- amended method statement and how you addressed peer review feedback, including any suggested changes that were not made and why
- appropriate handover documentation.

Additional evidence of your performance that must be captured for marking:

- assessor observations of the handover meeting.

Candidate Evidence

Task 4 - Practical observation form

8712-312 Maintenance Engineering Technologies: Mechatronic - Summer 2025

Candidate Name	Candidate number
<candidate>	ABC1234
Provider name	**Date**
<provider>	April 2025

Complete the table below referring to the relevant marking grid, found in the assessment pack.

Do not allocate marks at this stage.

This observation must cover	Assessor observation should include:	Assessment Themes
Handover	• the handover of the work completed.	• Health and Safety • Reviewing and Reporting

Notes – *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Handover The candidate followed most handover procedures; however, they did not discuss all faults found AND RECTIFIED. The candidate mentioned some basic H&S information; however, there was no mention of LOTO procedures or amendments made to the risk assessment. They spoke to the audience using some appropriate terminology. The candidate had relevant documentation ready to handover, giving some explanation, whilst using a range of appropriate communication methods such as vocal and physical demonstration. They explained all the faults and the methods used to correct them. A brief operational demonstration of system functionality, with some verbal description of work, which may not be communicated accurately, was completed (See images 3,4,36).

Internal assessor signature	Date
XX	April 2025

If completing electronically, double-click next to the 'X' to add an electronic signature once the record is **finalised**.

Principal Moderator Commentary

The candidate demonstrated a foundational interpretation of technical information within their plan and method statement. During practical observation, there was some basic analysis of technical documentation, but more detailed scrutiny would be needed to achieve a middle or higher bank mark. The method statement would have been strengthened by the inclusion of collated technical documentation and clear evidence of its application. For improvement, the plan should have included explicit references to technical manuals and engineering drawings to enhance clarity and accuracy. For example, citing the manufacturer's manual for a programmable logic controller (PLC) would provide essential details such as wiring diagrams and programming instructions, supporting a more robust and informed approach.

The candidate demonstrated an emerging understanding of risk assessment principles, identifying common hazards and suggesting some control measures. Their approach showed an awareness of severity, which aligns with the expectations of the lower band. The inclusion of specific procedures, such as lockout/tagout (LOTO), would have demonstrated a more thorough understanding of risk control. Additional references to the Health and Safety at Work Act 1974 or the Control of Substances Hazardous to Health (COSHH) Regulations 2002 would have established a legal framework for hazard identification and mitigation. Furthermore, expanding on the use of personal protective equipment (PPE) and detailing its application to each identified risk would further strengthen the assessment.

The candidate demonstrated a basic level of practical competence and showed some understanding of core processes. They needed to show greater attention to detail in key areas. Specifically, the isolation process should be more clearly defined and consistently applied. Preparation of the workspace would benefit from a more thorough approach, particularly in relation to health and safety protocols. Additionally, incorporating routine checks on the quality and performance of tools would strengthen the overall assessment and support safer, more effective working methods.

When changing settings on a PLC, the candidate should have provided a step-by-step explanation, such as connecting the PLC to a computer, opening the programming software, and uploading the new settings. In testing sensors, they should have described the process, such as using a multimeter to check for continuity or verifying the output signal.

The candidate showed some initial attention to setting up the work area. There was evidence of some effort in organising tools and equipment, although incomplete, which provided a foundation for the task. Their method statement would benefit from greater detail, particularly in outlining the steps required to prepare the work area in line with health and safety standards. Additionally, ensuring the area is made fully safe prior to starting the task would support a more robust and compliant working environment.

Ideally, the candidate should have ensured that all tools were systematically arranged and easily accessible to avoid delays and hazards. A well-organised work area is essential for

both efficiency and safety and would have moved the marking to the higher bands. The candidate should have included specific measures, such as marking hazardous areas, ensuring proper ventilation, and verifying that all safety equipment was present and functional. These steps are necessary for creating a safe and compliant work environment.

The candidate demonstrated a basic understanding of housekeeping processes. A comprehensive housekeeping plan should cover regular cleaning schedules, proper storage of materials, and immediate waste disposal. Reference to relevant regulations, such as the Waste Electrical and Electronic Equipment (WEEE) Regulations, would ensure the proper disposal of waste materials, help maintain a clean and safe environment, and support compliance with legal requirements, in order to reach higher attainment.

The candidate displayed some basic technical skills in maintaining, installing, repairing, and diagnosing components, assemblies, and sub-assemblies as per the brief in their method statement and practical observation form. To improve their work further, they should have provided links to technical specifications or manufacturer’s settings, which are crucial for accuracy and compliance with industry standards and are necessary for achieving a middle to higher band mark.

They could have referenced the manufacturer's manual for specific components, providing details such as torque settings, wiring diagrams, and calibration procedures. A more detailed breakdown of the processes would also be beneficial. For example, when installing a new component, the candidate should have included steps like securing mounting brackets, connecting electrical wiring, and performing functional tests. This level of detail ensures all personnel understand their roles and can accurately follow procedures.

Furthermore, the candidate should have offered a step-by-step explanation of diagnostic processes. For example, diagnosing a PLC system fault might involve connecting the PLC to a computer, using diagnostic software, and implementing corrective actions. This approach would more clearly demonstrate technical skills and the ability to troubleshoot and resolve issues.

The candidate demonstrated adequate skills in using tools and equipment for mechatronic maintenance, installation, and repair, including the safe isolation, removal, and replacement of components. More in-depth reasoning and detail in the method statement, parts list and observation report would have elevated their work. The candidate should have explained the rationale behind each step, such as why particular tools were chosen and how they contributed to safety and efficiency. Furthermore, references to tool settings or calibration methods in their documentation would have evidenced deeper understanding required for middle and higher bands. Including specific details about tool settings and calibration ensures accuracy and compliance with specifications. For instance, mentioning torque settings for bolts or the calibration procedure for a multimeter would provide the necessary clarity.

The candidate demonstrated some safe practices in isolation, although their approach needed more detail. A comprehensive approach should include a step-by-step lockout/tagout (LOTO) procedure, verification of isolation, and the use of personal protective equipment (PPE). For example, detailing the process of isolating the power supply, verifying de-energisation, and using appropriate PPE would provide a more complete demonstration of safe practice.

The candidate demonstrated some basic knowledge and understanding of the principles and processes required for disassembly, repair, configuration, and reassembly of mechatronic systems. To improve their work, they should have made reference to data sheets and manufacturer's guidelines, which are vital for accuracy and compliance with industry standards.

Improvements could include referencing the manufacturer's manual for component specifications, wiring diagrams, and calibration procedures. The candidate also failed to provide suitable references for tolerances and tightening torques, which are necessary to meet technical specifications. Details such as torque settings or acceptable tolerance levels for alignment would clarify and standardise their maintenance work.

Additionally, a more detailed breakdown of the disassembly process should be included. For example, identifying and labelling each component, using appropriate tools, and documenting the process for future reference would ensure clarity and accuracy for all personnel involved.

The candidate demonstrated adequate safe working practices and a suitable level of awareness in preparing and applying processes. An improved level of detail in the recording of the selection of tools, equipment, materials, and components for maintenance, installation, and repair activities would have improved the method statement.

To improve their work further, their method statement should include a comprehensive list of required tools and equipment for each task, with specific settings and calibration methods. For example, specifying torque settings or calibration procedures ensures accuracy and compliance with technical standards.

Furthermore, a more detailed outline of the processes is needed. This should include a step-by-step breakdown of each task, safety precautions, and quality checks. For instance, when installing a new component, steps such as securing brackets, connecting wiring, and performing functional tests should be detailed to ensure clarity and accuracy.

The candidate showed an emerging familiarity with industry and technical terminology across various communication methods, with room to further develop accuracy and consistency. While there was some consideration for both technical and non-technical audiences, the depth and breadth of terminology needed to be improved for a more technical audience.

A higher band would require, for example, the use of specific terms such as "ladder logic," "input/output modules," and "scan cycle" when discussing PLC operation. These terms are essential for conveying detailed technical information to a knowledgeable audience.

By broadening the use of industry-specific terminology and providing detailed explanations, the candidate would be better equipped to communicate with a technical audience and demonstrate a higher level of expertise.

Get in touch

The City & Guilds Quality team are here to answer any queries you may have regarding your T Level Technical Qualification delivery.

Should you require assistance, please contact us using the details below:

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