



HM Government

**T-LEVELS**

**T Level Technical Qualification in  
Maintenance, Installation and  
Repair for Engineering and  
Manufacturing (8712-32)**

**Maintenance Engineering  
Technologies: Mechatronic (312)**

**Guide standard exemplification  
material**

**Threshold Competence – Sample  
2022**



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## Introduction

The sample assessment materials within this document refer to the Maintenance engineering technologies: Mechatronic sample occupational specialism assignment. The aim of these materials is to provide centres with examples of knowledge, skills and understanding that attest to minimal threshold competence. The examples provided do not reflect all evidence from the sample assignment as the focus of this material is the quality and standards that need to be achieved rather than the volume of exemplar evidence provided. However, the examples provided are representative of all tasks in the sample assignment. The evidence presented here has been developed to reflect minimal threshold competence within each task but is not necessarily intended to reflect the work of a single candidate. 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. Minimal threshold competence will be based on a synoptic mark across all tasks.

The materials in this Guide Standard Exemplification Material (GSEM) are separated into the sections as described below. Materials are presented against a number of tasks from the assignment.

### Task

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 photographic evidence. Also referenced in this section are the assessment themes the candidates will be marked against when completing the tasks within it. In addition, candidate evidence that has been included or not been included in this GSEM has been identified within this section.

In this GSEM there is candidate evidence from:

- Task 1
- Task 2
- Task 3
- Task 4

### 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 centre assessors. This will be exemplar evidence that was captured as part of the assessment and then internally marked by the centre assessor.

### Commentary

This section includes detailed comments to demonstrate how the candidate evidence attests to the standard of minimal threshold competence by directly correlating to the grade descriptors for this occupational area. Centres can compare the evidence against the performance indicators in the marking grid descriptors within the assessor packs, to provide guidance on the standard of knowledge, skills and understanding that need to be met for minimal threshold competence.

It is important to note that the commentary section is not part of the evidence or assessment but are evaluative statements on how and why that piece of evidence meets a particular standard.

## Grade descriptors

**To achieve a pass (threshold competence), a candidate will typically 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 re-assembly 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 the maintenance activities

(Assessment themes: Health and safety, Planning and preparation, Systems and components)

For task 1 candidates need to produce the following pieces of evidence:

- a) list of requirements and resources, including justifications for the selections
- b) completed risk assessment
- c) method statement.

### Candidate evidence

#### 1a. List of requirements and resources, including justifications for the selections.

Requirements and Resources	Quantity	Justification
<b>Tools/equipment/materials</b>		
Power supply and pneumatics	1	Power up the system.
Replacement parts	6	To replace any failed parts.
Network system	1	Wired network required to control the system and for PLC communication.
Screwdrivers	3	Different types of screwdrivers for different activities.
Pliers	3	To hold items or help with removal.
Torx drivers	1 set	To remove and refit torx screws.
Multimeter	1	For electrical testing, if required.
Laptop	1	Required to control and adjust the system.
<b>PPE</b>		
Gloves	1	To reduce chances of injury to hands.
Overalls	1	To protect the body from dirt and debris.
Safety shoes/boots	1	To reduce chances of injury to feet.
<b>Technical Information/documentation</b>		
Manuals	For the SCARA robot and PLC equipment.	
Risk assessment	To complete before beginning the task.	
Method statement	To follow during the task.	
<b>Waste disposal</b>	Wiring and general waste separated.	
<b>Time needed</b>	Work area 1 hour Inspect 4 hours Repair 3 hours Return to service 2 hours.	
<b>Access requirements</b>	None.	
<b>Fault finding/diagnostic techniques and methods</b>		
Visual inspection	Checking for any visual faults/components not connected etc.	
Input to output	What's expected happens. Operates as expected.	
Half split technique	Break the system down to locate the fault.	

## Commentary

The candidate has interpreted the requirements of the brief and applied their understanding to produce an adequate list of resources required, demonstrating technical knowledge for the system and maintenance requirements. For example, they recognise that air and electricity is required and the need to work using manuals. The candidate has noted the need for various tool types due to robotics that use various fixtures and fittings – demonstrating understanding of the need for more than just a specific screwdriver etc.

The candidate has listed the amounts of each resource that they have planned to use, however their response lacks specific reference for the reasons why each amount is required. More specific referencing would have supported the candidate's response by showing where they had considered the use of 5S techniques, time-saving and possibility of system downtime.

The candidate has recognised the need to refer to supporting technical documentation in order to complete the task. There is limited detail provided on what documentation they would use, with no specific reference to assignment brief, specification, or diagrams, which could lead to errors or ineffective time management. This is also shown in their planned timings which only account for 10 of the 11 hours allocated.

The candidate has interpreted the technical information to identify fault finding and diagnostic techniques and methods that are appropriate for the system to correctly diagnose faults and inform the appropriate resolution methods. They have not provided justifications or details of the methods, demonstrating knowledge of the processes to be followed but not fully understanding the reasoning behind them.

The candidate has demonstrated planning for safe working by identifying appropriate PPE and stating why each piece should be used, but some areas lack additional precaution measures showing a lack of detail in their planning. To develop this area further, additional pieces could also be listed, including safety glasses and an electrostatic discharge mat, which would provide additional safety measures to the activities.

## 1b. Risk assessment

Risk Assessment				
Hazard	Risk	Control	Likelihood	Severity
Working area throughout the maintenance and fault finding activities needed on the SCARA robot	Slips, trips and falls.	Ensure area is clean and tidy throughout preparation, maintenance and upon completion. Wear PPE at all times.	1	1
Manual handling of tools and equipment needed for maintenance	Back injury.	Do not lift over maximum lifting limit. Ensure correct training has been received.	1	1
Working with stored energy (temperature) whilst carrying out maintenance on the SCARA robot	Burns, scalding, injury.	Ensure that correct procedures are followed when working on the system and when powered on. Allow components to cool before removing.	2	2
Working with stored electrical energy	Burns, electric shock.	Ensure that correct procedures are followed and all stored energy is safely discharged. Observe appropriate cool down periods.	3	2
Moving machinery/robotic arm	Crushing, trapping injury.	Ensure correct PPE is worn. Follow LOTO and deenergise the system.	2	2
Using hand tools and equipment to undertake maintenance and fault finding on the SCARA robot	Cuts, abrasions, general hand injury.	Ensure proper use of tools and equipment, particularly wire cutters and crimpers. Ensure correct PPE is obtained and worn, such as gloves when working with hot components and safety glasses to protect from flying debris e.g. when snipping wires.	1	1
Electricity when working on the SCARA robot which is a live system	Electrocution.	Safe isolation following ELV guidance.	3	4
Equipment malfunction/faulty components	System heating up when working on it.	Safe isolation following ELV guidance.	2	2

Likelihood		Severity	
1	Very unlikely to happen	1	Minor injury
2	Unlikely to happen	2	Major injury
3	Possible to happen	3	Loss of limb
4	Likely to happen	4	Death of an individual
5	Very likely to happen	5	Multiple death

## Commentary

The candidate has considered and identified hazards and risks associated with the maintenance and fault-finding activities on the system to ensure safe working is followed. All risks and hazards identified are relevant to the task and system to be worked on demonstrating their understanding of risk identification and mitigation whilst completing maintenance activities. For example, the candidate has identified the need to follow regulations to ensure safe isolation and rating the severity of electrocution at a 4. To develop the response further, the candidate could categorise each element of the activity and identify hazards for each part, demonstrating a deeper understanding of risks and hazards in the workplace to ensure the safety of themselves and others. For example, the work area preparation – pre check the work area for hazards, maintenance – keeping dismantled items in specific boxes and fault finding – working in a way which reduces risk to the component, and others.

The candidate has considered an appropriate control measure for each of the hazards identified, demonstrating acceptable knowledge for risk mitigation techniques in order to demonstrate that they are able to work safely. However, the measures identified lack specific detail, and do not appear to demonstrate that the candidate has considered a variety of scenarios or situations that could arise during the maintenance activities. Further consideration of a wider range of control measures and a greater level of detail would have developed the candidate's response further.

The candidate has labelled the likelihood and severity for each risk and hazard, with some accuracy. For example, working with stored energy is correctly rated as likelihood 2, severity 2. This demonstrates an acceptable standard of understanding and awareness of risk assessment and mitigation, and therefore safe to work. The candidate could have developed their response further by considering the likelihood and severity of all identified hazards and risks with a higher degree of accuracy. For instance, acknowledgement that risks may only cause minor injury, but would be of a higher likelihood rating, such as hand tools and equipment should be rated as 2 for likelihood, and 1 for severity, rather than 1 for both.

## 1c. Method statement

### Maintenance

- I will collect my PPE, tools and equipment needed for the task.
- Put on PPE and visually check the area for any hazards.
- Remove any objects or items that may cause injury and put out warning signage.
- I will work adhering to the Health and Safety at Work Act.
- Inspect the system visually.
- Test run the robot.
- Check the control console and then plug in the laptop to read error codes.
- I will then fault find with it running and disconnected from the main supply (both electrical and pneumatic).
- I will then clean the system down and check connections of equipment and components.
- I will power down the system and remove the fuses. I will then isolate the system following isolation procedures (LOTO).
- I will strip down the robot and complete the required maintenance in a logical order.
- I will rebuild the robot and make sure everything is aligned and where it should be to operate properly.
- When rebuilding I shall make sure that no wires or hoses are caught in the assembly.
- I will also make sure that all fixings are secure and tightened.
- Once the system is powered back up, I will complete a function check by running a program.
- I will then tidy up the working area, taking tools and equipment back to the correct place and ensuring that any waste is dealt with correctly.
- I will then handover the task to my supervisor.

### Commentary

The method statement is clear and demonstrates basic knowledge and understanding for the maintenance processes and accurate sequencing of tasks. For example, firstly inspecting the system for any visual defects, before test running the robot. The response could have been developed further with greater detail of what they plan to do, communication with others working in the area and planning for a variety of scenarios arising.

The candidate has considered and referred to one regulatory requirement, the use of PPE and ensuring working area is checked, demonstrating the candidate is following workplace regulations. The response could have been developed by referring to a wider range of regulatory requirements, such as WEEE waste disposal and guidance documents, and how they are applied.

The method statement lists the candidate's proposed actions in a bullet list form which can be easily followed in Task 2, however it is lacking detail of intended actions and techniques. This shows adequate planning but could be developed further with more detail and supporting justifications at each stage. For example, demonstrating datum alignment of the gears, identifying the purpose of these and the use of grease on the J1 and J2 axis would

have shown a more developed understanding of the actions. They could also have stated clearly why they would be undertaking these at this stage. This would have shown a deeper understanding of the process they were intending to follow.

## **Task 2 – Perform the maintenance activities**

**(Assessment themes: Health and safety, Systems and components, Working with faults, Reviewing and reporting)**

For task 2 candidates need to produce the following pieces of evidence from completing the maintenance activities:

- completed test record sheets
- updated maintenance records and control documents
- annotated method statement, including any recommendations for further investigation if required.

For task 2, assessors will need to produce the following pieces of supporting evidence from the maintenance activities:

- assessor observations of:
  - work area preparation
  - the maintenance activities.

### **Photographic evidence required:**

- Photographic evidence showing the prepared work area - Illustrated in Task 2 photographic evidence section below (photographs 1, 2 and 3)
- Photographic evidence showing the working area after disassembly - Illustrated in Task 2 photographic evidence section below (photographs 4, 5 and 6)
- Photographic evidence showing the refitted belt showing the correct fitment to the pulleys – Illustrated in Task 2 photographic evidence section below (photographs 7 and 8)
- Photographic evidence showing the re-instated work area – Illustrated in Task 2 photographic evidence section below (photograph 9)

## Candidate evidence

### 2. Completed test record sheets

#### Test record sheet 02/04/2022

##### Actions completed

- The faulty transformer and worn belt were resolved.
- Planned maintenance completed – following the schedule of work in the manual.

System was then ready for final testing.

##### Testing of the system

##### Measurements taken -

The table below shows the output signal values measured using a multimeter and oscilloscope.

Circuit/system block	Expected output V	Output V from initial tests
Transformer	12 V DC	0 V DC

Measurements confirm problem with transformer.

- Power and pneumatics supplied to the system; then powered up.
- Checked that the robot was running.
- Checked the indication lamps on the control console to confirm communications and operations.
- Confirmed that the system was in fact up and running and working as it should be.

Testing of the SCARA Robot is now complete, and the system can be handed back over to the supervisor. The next step is to complete the maintenance log with details of work completed and review any documents.

### Commentary

The candidate has completed a basic test record, with adequate detail of the actions taken and testing completed. The candidate has provided details of the different steps taken, that follow a logical sequence. The candidate could have developed their response further by providing more comprehensive detail of the different steps, including how testing was completed with reference to corresponding remedies.

The candidate has recorded the results of initial numerical tests and displayed these clearly in a table against the expected results, demonstrating their understanding of tests and recording the results of testing for maintenance. To develop the response further, the candidate could include the results of the final output voltage tests for each individual block of the system, post maintenance and fault diagnosis, and how these compare directly to the initial measurements taken.

## 2. Updated maintenance records and control documents

<b>Maintenance log</b>							
				<b>System type:</b>	Mitsubishi RH-5AH series SCARA robot		
				<b>System TAG number:</b>	1A2B3C		
				<b>Department responsible for equipment:</b>	Maintenance engineering department		
<b>Date:</b>	<b>Maintenance performed by:</b>	<b>Maintenance description:</b>	<b>Work completed outside the scope of the maintenance:</b>	<b>Are any problems identified rectified? Y/N</b>	<b>Validation performed by:</b>	<b>Next maintenance due date:</b>	<b>Comments:</b>
03/04/2022	Candidate.A	Scheduled maintenance and intermittent fault diagnosis.	The system was indicating an error. The power supply transformer was rectified, ensuring the connections were electrically and mechanically sound. The maintenance tasks were completed to include a belt change.	Y		03/04/2022	The job has been completed, however it is advised the maintenance schedule is revisited.

### Controlling of documentation log

Date:	Checking of documentation performed by:	Are diagrams and specifications up to date?	Are risk assessments in date and applicable to the task?	Person to revise any issues with diagrams and specifications:
03/04/2022	Candidate.A	Yes.	Yes. Area risk assessment has been checked and is in date.	All documents are complete, valid and in date.

### Commentary

The candidate has filled in the maintenance documentation correctly, information provided is relevant and complete and there are minimal errors. To develop the response further, more information and detail could have been recorded on the forms. For example, the control console was indicating a fault when investigating and a faulty transformer was found.

The candidate has completed the control documentation with basic detail, confirming documentation used is up to date. To develop the response further, the candidate could add additional detail which could be referenced easily in future, such as the document version number, any recommendations to update the documents and the reporting process where any errors are identified.

## 2. Annotated method statement

### Maintenance

- I will collect my PPE, tools and equipment needed for the task.
- Put on PPE and visually check the area for any hazards.
- Remove any objects or items that may cause injury and put out warning signage.
- I will adhere to the Health and Safety at Work Act.
- Inspect the system visually.
- Test run the robot.
- Check the control console and then plug in the laptop to read error codes.
- Record and clear the codes, run the system again to find the most recent faults logged.
- I will then fault find with it running and disconnected from the main supply (both electrical and pneumatic).
- I found a faulty transformer and replaced this.
- I will then clean the system down and check connections of equipment and components.
- I will power down the system and remove the fuses. I will then isolate the system following isolation procedures (LOTO).
- I will strip down the robot and complete the required maintenance in logical order.
- Upon inspecting the belt, I found this to be excessively worn and so replaced it.
- I will rebuild the robot and make sure everything is aligned and where it should be to operate properly.
- When rebuilding I shall make sure that no wires or hoses are caught in the assembly.
- I will also make sure that all fixings are secure and tightened.
- Once the system is powered back up, I will complete a function check by running a program.
- I will then tidy up the working area, taking tools and equipment back to the correct place and ensuring that any waste is dealt with correctly.
- I will then handover the task to my supervisor.

### Commentary

The candidate has demonstrated a basic knowledge and understanding of the steps to correctly complete the maintenance on the system in order to diagnose and resolve faults.

The candidate has indicated at what intervals the scope of work changed from their planned method statement, showing interpretation of the system and fault detection results as they were working on the system. To further develop the response, the candidate could have provided further detail on what fault resolution methods were chosen and how the detection and diagnosis informed them.

## 2. Practical observation form – work area preparation

<b>Assessment ID</b>	<b>Qualification number</b>
8712-312	8712-32
<b>Candidate name</b>	<b>Candidate number</b>
Candidate A	CG12345
<b>Centre name</b>	<b>Assessment theme</b>
City & Guilds	Health and safety Planning and preparation

Complete the table below referring to the relevant marking grid, found in the assessment pack. **Do not** allocate marks at this stage.

<b>Task</b>	<b>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.</b>
Work area preparation	The candidate gathered the tools, equipment and PPE listed in their resources list and checked the condition and calibration date of each. There did not appear to be any logical sequencing of tools and equipment placement in the working area. Visual inspection. Technical information, including their risk assessment, was placed within reach of the working area but the candidate did not find the specific information for the task prior to starting work. All basic health and safety requirements were followed before the maintenance activities began. Appropriate warning signs were placed outside the work area to advise others. Use of a barrier could have been considered.

<b>Assessor signature</b>	<b>Date</b>
Assessor.1	02/04/2022

### Commentary

The candidate demonstrated an acceptable approach to preparing to work through undertaking basic preparatory checks of the work area. The candidate demonstrated consideration of checks across a range of key areas, such as checking the basic condition of tools and ensuring visual checks of the area.

The candidate could have developed their response further by showing a more logical approach to their preparation. For example, resources were placed in the work area, but were noted as not having been considered with any particular workflow or logic in mind. Considering this in more detail would have shown the candidate's awareness of how this would support the efficiency and accuracy of their work in subsequent tasks.

## 2. Practical observation form – maintenance activities

<b>Assessment ID</b>	<b>Qualification number</b>
8712-312	8712-32
<b>Candidate name</b>	<b>Candidate number</b>
Candidate A	CG12345
<b>Centre name</b>	<b>Assessment theme</b>
City & Guilds	Health and safety Systems and components Working with faults Reviewing and reporting

Complete the table below referring to the relevant marking grid, found in the assessment pack. **Do not** allocate marks at this stage.

<b>Task</b>	<b>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.</b>
Decommissioning, disassembly and inspection	The candidate correctly followed all steps of isolation procedures before starting work on the system. The candidate disassembled the system correctly, referring to the method statement and technical information regularly as an aid. A short cool down period of 2 minutes was observed but could have been longer. Correct sub-assemblies and components were removed, with wires disconnected, and placed onto a work bench.
Fault detection and diagnosis	The candidate completed some visual and physical checks and then addressed the control console, identifying the issue of the control console displaying a faulty indication light. The candidate did not diagnose or rectify the overheating motor fault. The candidate moved onto the maintenance process and discovered the excessively worn belt. The candidate changed the belt and eventually tensioned it correctly after realising their error. After assembly, the candidate completed a system function check to confirm fault rectification, and so did not complete in a fully logical order or following processes.
Reassembly and recommissioning	<p>The candidate obtained and set up the datum points with minor problems, initially setting these incorrectly, identifying this and rectifying. The candidate completed the maintenance process, but due to not identifying the failed motor, the system was not working within specified tolerances. The candidate mostly returned tools and equipment to appropriate storage but did not clean down these before returning them.</p> <p>The candidate tensioned the belt incorrectly to begin with but acknowledged and tensioned correctly upon realisation. The candidate then re-energised the system and completed a test run.</p>

<b>Task</b>	<b>Notes</b> – <i>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.</i>
Working area	The candidate worked safely through all activities, following appropriate workshop requirements. Disconnected wires and components were placed on a bench, rather than in containers which could have resulted in a trip hazard if knocked off the bench. The candidate returned tools and equipment to appropriate storage containers but did not clean them all down thoroughly and left the containers in the workshop.

<b>Assessor signature</b>	<b>Date</b>
Assessor.1	03/04/2022

## Commentary

The candidate was able to demonstrate maintenance techniques showing competent and correct use of tools and equipment to ensure the maintenance was completed to an adequate standard, although fault finding was not completed in the most logical order, for example checking connections before checking the state of the control console. The candidate was able to correctly diagnose and resolve three of the four faults within the system.

Whilst the candidate was able to complete the maintenance to an adequate standard, there were instances where the candidate needed to reattempt a step in order to get the correct result. For example, the candidate set up the belt tension equipment incorrectly on their first attempt but was able to rectify before proceeding with tensioning the belt. As the candidate had not diagnosed and resolved the faulty motor, the system could not be calibrated within the manufacturer's specified tolerances, so although the system was working, it could not produce accurate functions. The candidate could have demonstrated their maintenance ability further by ensuring all areas of the system were fully operational and working to manufacturer specifications before undertaking a full test run.

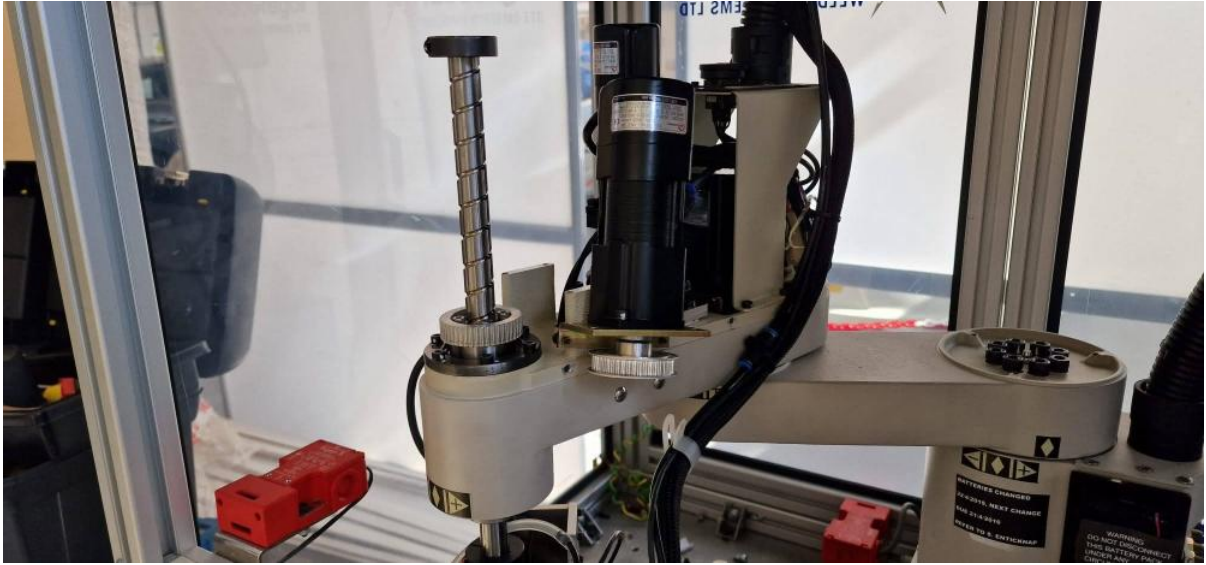
## 2. Photographic evidence.

**Photographs 1, 2 and 3:** Photographic evidence shows the candidate has prepared the work area with some consideration of the task. Tools and equipment have been gathered and placed in the area but lack logical sequencing and some are still concealed in the toolbox. Technical information has been placed to hand but is not set to the specific information needed for the task. A health and safety warning sign has been placed just outside the work area to warn other users of the work being undertaken.

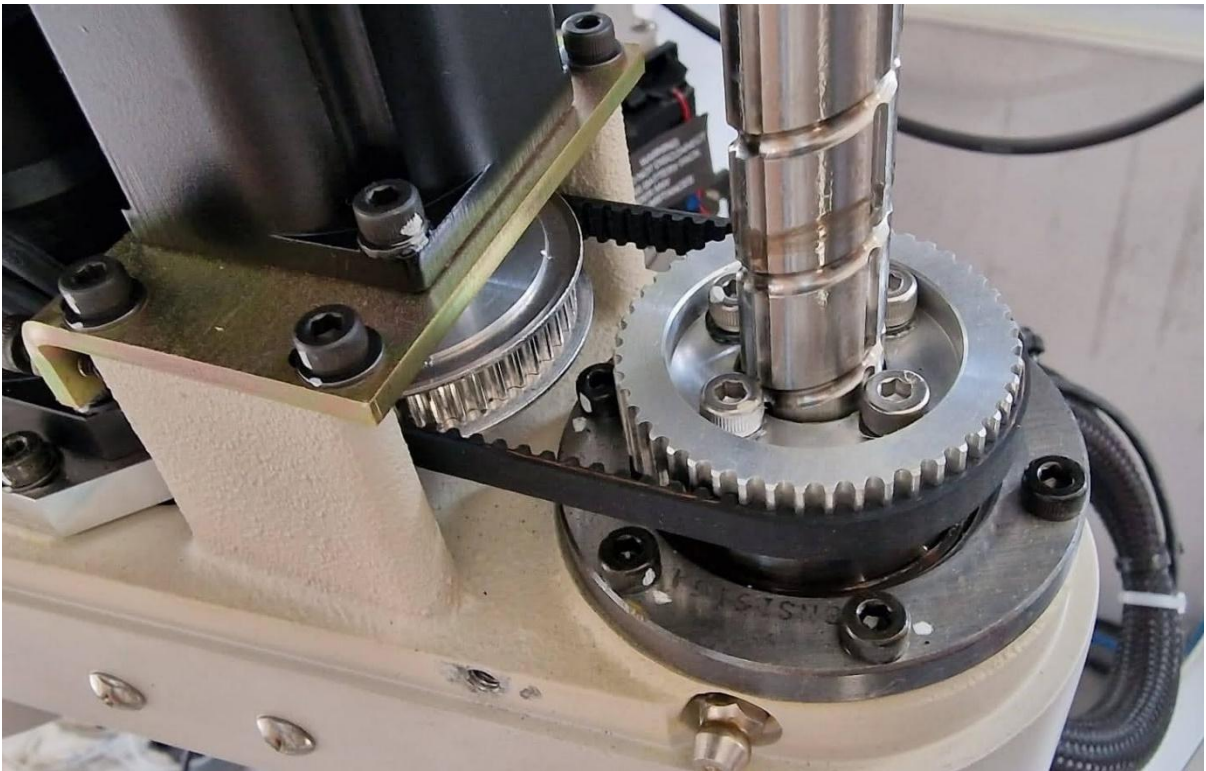


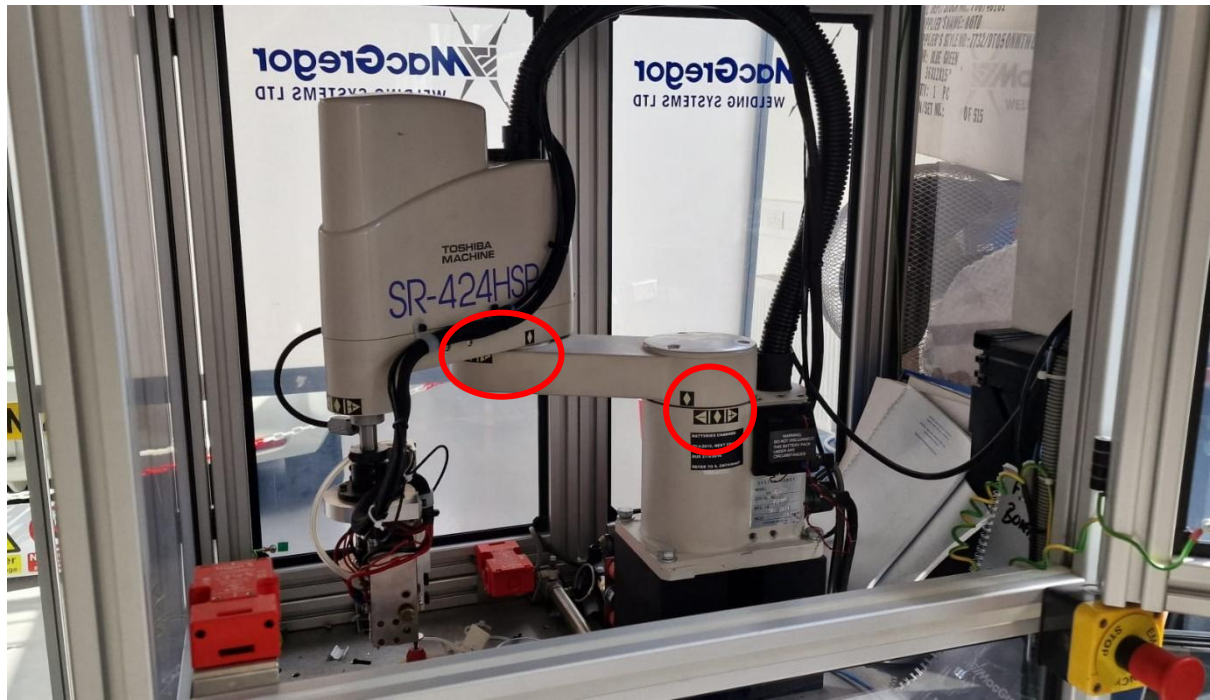
**Photographs 4, 5 and 6:** Photographic evidence shows the working area after disassembly. Note, components and sub-assemblies placed on bench rather than in separate containers.





**Photographs 7 and 8:** Photographic evidence shows the refitted belt and correct fit to the pulleys but has not been correctly realigned as shown by the highlighted markings.





**Photograph 9:** Photographic evidence shows the re-instated working area including the system showing overall condition and working area, tools or equipment returned to their proper toolboxes but left in the workstation.



## Task 3a - Review and report the maintenance activities

(Assessment themes: Health and safety, Systems and components, Reviewing and reporting)

For task 3a candidates need to produce the following pieces of evidence:

- technical report
- revised maintenance schedule, including justifications.

### Candidate evidence

#### 3a. Technical report

Mitsubishi RH-5AH series SCARA robot	04/04/2022
<p>The SCARA Robot needed the scheduled maintenance to be completed. The robot to be maintained is used for repetitive assembly process. The system also includes a control console with a PLC which is used to access and control the robot.</p> <p>The maintenance included fixing any faults that had been reported or other faults that I might have come across during the task. The information required for the task was provided through a brief as well as specifications of the system which were used to check the robot was functioning as it should.</p> <p>Before beginning the task, I completed a method statement as requested in task 2. The method statement gave me steps to follow as I worked through the maintenance. I also completed a Risk Assessment as this is important before conducting any work and was also a requirement of the task. I used the scoring table to decide the likelihood and severity of the risks.</p> <p>Before beginning the task, I gathered all of the PPE and the tools and equipment listed in the materials list. I made sure that the area was clean and tidy before entering the area and setting up the working area, tools and equipment. The first task that needed to be completed was visual inspections to visually check the condition of the system and identify any damage or wear and tear to the system. I checked the control console for faults indicated.</p> <p>When I looked at the control console, I could see that there was an error. This required a laptop to be plugged in to interrogate the system. The errors listed were large, so I cleared this and then operated the robot. The error code displayed after operation indicated a power supply fault. I used a multimeter on the supply voltage and discovered it was much lower than expected. I asked for a new transformer for the robot, this was then installed (making sure the power supply was off). There still seemed to be an issue with the machine as an error code was still present on the display after replacing the faulty transformer and clearing the error codes. I am unsure what the cause of this error code is, so I recommend further investigation to interrogate the system further. For further investigation I would also recommend the unit substitution fault diagnosis technique to find any further faulty components within the system.</p> <p>I then continued with the maintenance required. I dismantled the robot and lubricated the joints with the required grease and oil. I then continued to dismantle to gain access to the belt. This was worn excessively. This was visible and may have happened due the length of time this has been on the robot. Due to the wear and tear of the belt, the most appropriate action for me to take was to replace the belt. I gained a new belt and fitted it.</p>	

When fitting I tried to tension it and realised that this was incorrect (after rotating the belt). I then gained the belt tensioning tool to help me do this properly.

I re-assembled the robot making sure to follow the datum alignment markings and making sure everything was tight and secure.

After completing the maintenance task, I made sure that the area was left clean and tidy. I did this by taking all the tools and equipment back to the correct place and putting all rubbish in the bin. Stock used was:

- drive belt
- 1 transformer
- multi-purpose grease.

All waste was disposed of in general waste, segregating the electrical waste and placing that in the designated WEEE bin.

## Commentary

The technical report provides a basic technical account of the maintenance activities carried out, technical terminology is correct but limited, for example there is no reference to the original faults and use of diagnostics enabling thorough fault findings.

The candidate has described the steps that were taken to complete the maintenance activity. The response largely provides a clear, but simplistic overview of what the candidate did, and what happened during the activity. Although the report has been developed following a clear and logical sequence which reflects the activities undertaken, it would benefit from being developed in further detail. The candidate could have developed their response by explaining in more detail each of the steps taken, as well as providing justifications of their actions showing consideration for system downtime. The candidate would also have benefitted from making clear and detailed recommendations for additional actions to take before the next maintenance scheduled.

The candidate has reported the stock used to complete the maintenance by listing some quantities of components and materials used, and how they disposed of their waste. The response could be further developed by noting exact levels of all stock used, such as the exact amount of multi-purpose grease, and what was left in the stock cupboard, then reporting this to the supervisor.

### 3a. Revised maintenance schedule

System:	Findings during maintenance:	Recommendations to seniors:	Justification to seniors:	Recommended next planned maintenance due date:
SCARA Robot	<p>Transformer faulty, providing inefficient supply to the robot. This can be caused by faulty part.</p> <p>Worn belt, indicates excessive use of the motor or poor operation of the robot.</p> <p>Error still displayed on console.</p>	<p>It is recommended that the company notify us of any faults immediately as one fault could lead to another.</p> <p>I recommend increasing the regularity of the maintenance because of its consistent use. Currently 12 months but recommend increasing this to 6 monthly.</p>	<p>This will save money as maintenance engineers will not need to spend as much time rectifying the issues during a service.</p>	<p>03/10/2022</p> <p>Further investigation ASAP</p>

### Commentary

The revised maintenance schedule has been completed correctly with minimal detail on the findings during the maintenance.

The candidate has considered the outstanding maintenance issues and produced a basic, but accurate, justification for increasing the frequency of scheduled maintenance activities. The candidate has also identified that another urgent inspection is needed due to potentially unresolved faults, but not specified exact timescales for this.

The candidate considered the use of the robot and how its use will affect the calibration requirements. The candidate provided only limited reference to causes or factors that relate to the system and which could cause the transformer to become unfit for use. Additional consideration of a wider range of factors would have demonstrated a broader understanding of the system and would have further developed the candidate's response.

## Task 3b – Peer review

### (Assessment themes: Reviewing and reporting)

For task 3b candidates will be asked to peer review two maintenance schedules and then be given two completed peer reviews to review and amend their proposed maintenance schedule. This is supporting evidence for assessors to see what suggestions have been given to each candidate in order to base their amendments on and will not be marked.

For task 3b candidates need to produce the following pieces of evidence:

- maintenance schedule amended from peer review feedback, including justifications.

### 3b. Peer review forms

<b>Candidate name</b>	<b>Candidate number</b>
Candidate.C	34567
<b>Centre name</b>	<b>Centre number</b>
ABCDE	12345

<b>How well does the schedule enable planned maintenance activities to be performed and recorded over time?</b>	<i>The schedule enables planned maintenance to be completed at more regular intervals which will improve system efficiency. The documents produced allow for the maintenance to be recorded clearly.</i>
<b>How appropriate are the recommended planned maintenance intervals and why?</b>	<i>After reviewing the issues that the system presented during the maintenance, the recommended planned maintenance intervals may not be appropriate, 6 months is still a long period of time for the nature of the system.</i>
<b>What are the implications to the business of the proposed maintenance schedule?</b>	<i>A revision to the maintenance schedule will mean that more time is being spent on the maintenance which may have a cost implication, however, overall will reduce costs as the system will be functioning more accurately and downtime will be reduced.</i>
<b>How can the maintenance schedule could be optimised/ improved?</b>	<i>Where candidate.A has reduced from 12 monthly to 6 monthly, I feel that the maintenance should be completed on a 3 monthly system as to maintain full accuracy and efficiency of the system. I would also recommend replacing the belt each time planned maintenance is carried out to prevent excessive wear and tear faults before they happen.</i>

<b>Candidate name</b>	<b>Candidate number</b>
Candidate.D	67891
<b>Centre name</b>	<b>Centre number</b>
ABCDE	12345

<b>Question</b>	<b>Feedback</b>
<b>How well does the schedule enable planned maintenance activities to be performed and recorded over time?</b>	<i>The documentation that is in place allows the maintenance steps to be recorded and stored efficiently and can be referenced back to during future maintenance activities. The planned maintenance activities are comprehensive and the schedule is appropriate for the tasks to be completed.</i>
<b>How appropriate are the recommended planned maintenance intervals and why?</b>	<i>After reviewing the issues that the system presented during the maintenance, the recommended planned maintenance intervals are appropriate.</i>
<b>What are the implications to the business of the proposed maintenance schedule?</b>	<i>The new maintenance schedule will mean that more time is being spent on the maintenance and have a cost implication, so seniors may not approve the update because of this.</i>
<b>How can the maintenance schedule could be optimised/ improved?</b>	<i>A revision to the schedule requires it to reviewed every 6 months. The purpose of having a service engineer onsite with this robot every 6 months is to prevent severe failure and malfunction which could lead to health and safety implications. No mention of faults being stored on the PLC, this should be included as it is important to note for the next maintenance engineer may collect fault codes that are old and not relative to the current faults on the system.</i>

## Candidate evidence

### 3b. Maintenance schedule amended from peer review feedback

System:	Findings during maintenance:	Recommendations to seniors:	Justification to seniors:	Recommended next planned maintenance due date:
SCARA Robot	<p>Transformer faulty, providing inefficient supply to the robot. This can be caused by faulty part.</p> <p>Worn belt, indicates excessive use of the motor or poor operation of the robot.</p> <p>Error still displayed on console.</p> <p>Faults logged on the PLC internally.</p>	<p>It is recommended that the company notify us of any faults immediately as one fault could lead to another.</p> <p>I recommend increasing the regularity of the maintenance because of its consistent use. Currently 12 months but recommend increasing this to 6 monthly.</p> <p>Replace the belt at each planned maintenance activity</p>	<p>This will save money as maintenance engineers will not need to spend as much time rectifying the issues during a service.</p> <p>Replacing the belt at each planned maintenance will avoid excessive wear and tear of it, ensuring system efficiency, reducing system downtime and reducing potential health and safety issues.</p>	<p>03/10/2022</p> <p>Further investigation to be completed by 10/04/2022.</p>
<p><b>Justification for changes:</b></p> <p>From peer feedback, it was highlighted that due to outstanding issues within the system with an error code remaining on the control console, this should state a date for further investigation and resolution to be completed. Based on this, I recommend this is completed within a week of today's date. Peer review feedback mostly agreed with the reduced intervals from 12 months to 6 months. One peer also recommended to replace the belt each time planned maintenance is carried out and I agree this would be a good idea to ensure system efficiency and reduce the potential for health and safety issues occurring.</p>				

### Commentary

The candidate has amended the maintenance schedule and highlighted where changes have been made for easy identification. For example, they have added an appropriate date for the reactive maintenance to be completed which will ensure this is recorded correctly as well as not prolonging system downtime. This demonstrates their ability to understand and respond appropriately to peer feedback received and understanding of the importance of preventative maintenance.

The candidate has taken on board elements of peer feedback and implemented changes where they agreed proposed changes were appropriate. The recommended reduced intervals to carry out planned maintenance demonstrates knowledge and understanding of

the benefit of regular planned maintenance to maintain system efficiency and reduce downtime.

Changes made are not always fully appropriate and may be more costly to complete. For example, the replacement of the belt each time planned maintenance is carried out, as this would only need to be replaced when wearing out and replacing early would create unnecessary waste.

The candidate has provided basic justifications for the changes made, for example the nature and consistent use of the robotic arm supports the change to increase the frequency of planned maintenance activities. Justifications for some changes are not fully correct. The response would have benefited from the candidate detailing more fully the technical reasoning behind decisions to adopt feedback. For example, why it is important for the reactive maintenance to be completed within one week.

## **Task 4 – Complete handover**

### **(Assessment themes: Health and safety, Reviewing and reporting)**

For task 4 candidates need to produce the following pieces of evidence:

- handover documentation.

For task 4, assessors will need to produce the following pieces of supporting evidence from the maintenance activities:

- assessor observations of the handover meeting.

The following task 4 supporting evidence has not been included for this version of the guide standard exemplification materials:

- video evidence showing the handover meeting.

## **Candidate evidence**

## 4. Handover documentation

Maintenance log							
<b>System type:</b>				Mitsubishi RH-5AH series SCARA robot			
<b>System TAG number:</b>				1A2B3C			
<b>Department responsible for equipment:</b>				Maintenance engineering department			
<b>Date:</b>	<b>Maintenance performed by:</b>	<b>Maintenance description:</b>	<b>Work completed outside the scope of the maintenance:</b>	<b>Are any problems identified rectified? Y/N</b>	<b>Validation performed by:</b>	<b>Next maintenance due date:</b>	<b>Comments:</b>
03/04/2022	Candidate.A	Scheduled maintenance and intermittent fault diagnosis.	The system was indicating an error. The power supply transformer was rectified, ensuring the connections were electrically and mechanically sound. The maintenance tasks were completed to include a belt change.	Y	<i>Assessor. 1</i>	03/10/2022	Planned maintenance completed, but error code still displayed on control console. Further inspection will be needed to investigate the cause of this. Reactive maintenance to be completed by 10/04/2022. Maintenance schedule updated.

**Controlling of documentation log**

<b>Date:</b>	<b>Checking of documentation performed by:</b>	<b>Are diagrams and specifications up to date?</b>	<b>Are risk assessments in date and applicable to the task?</b>	<b>Person to revise any issues with diagrams and specifications:</b>
03/04/2022	Candidate.A	Yes.	Yes. Area risk assessment has been checked and is in date.	All documents are complete, valid and in date.

Updated Maintenance Schedule				
System:	Findings during maintenance:	Recommendations to seniors:	Justification to seniors:	Recommended next planned maintenance due date:
SCARA Robot	<p>Transformer faulty, providing inefficient supply to the robot. This can be caused by faulty part.</p> <p>Worn belt, indicates excessive use of the motor or poor operation of the robot.</p> <p>Error still displayed on console.</p> <p><b>Faults logged on the PLC internally.</b></p>	<p>It is recommended that the company notify us of any faults immediately as one fault could lead to another.</p> <p>I recommend increasing the regularity of the maintenance because of its consistent use. Currently 12 months but recommend increasing this to 6 monthly.</p> <p><b>Replace the belt at each planned maintenance activity.</b></p>	<p>This will save money as maintenance engineers will not need to spend as much time rectifying the issues during a service.</p> <p><b>Replacing the belt at each planned maintenance will avoid excessive wear and tear of it, ensuring system efficiency, reducing system downtime and reducing potential health and safety issues.</b></p>	<p>03/10/2022</p> <p><b>Further investigation to be completed by 10/04/2022.</b></p>
<p><b>Justification for changes:</b></p> <p>From peer feedback, it was highlighted that due to outstanding issues within the system with an error code remaining on the control console, this should state a date for further investigation and resolution to be completed. Based on this, I recommend this is completed within a week of today's date. Peer review feedback mostly agreed with the reduced intervals from 12 months to 6 months. One peer also recommended to replace the belt each time planned maintenance is carried out and I agree this would be a good idea to ensure system efficiency and reduce the potential for health and safety issues occurring.</p>				

## Commentary

The candidate has provided a copy of the maintenance log, controlling of documentation log and updated maintenance schedule, obtained a signature from the supervisor on the maintenance log to show that the work completed has been verified and handed over. To develop the response further, the candidate could have ensured to also handover the test record sheet to the supervisor, which would ensure all reporting procedures were fully followed.

The candidate has demonstrated a basic understanding for the process of handing over documentation and adhered to the requirements of the task. To develop the response further they could have provided a more detailed account of the outstanding issues and exact dates when these should be looked at again, prior to the next scheduled maintenance activity taking place.

#### 4. Practical observation form – handover meeting

<b>Assessment ID</b>	<b>Qualification number</b>
8712-312	8712-32
<b>Candidate name</b>	<b>Candidate number</b>
Candidate A	CG12345
<b>Centre name</b>	<b>Assessment theme</b>
City & Guilds	Reviewing and reporting

Complete the table below referring to the relevant marking grid, found in the assessment pack. **Do not** allocate marks at this stage.

<b>Task</b>	<b>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.</b>
Handover	<p>The candidate provided an account of the work that they had undertaken during the maintenance activity. They briefly talked through the activity – outlining the changes that were made to their original planned method statement, and with a brief outline of why this happened. The candidate described that there was an error code still displayed on the control console which they were unable to identify the cause of and recommended further investigation to resolve, recommending that this is completed by 10/04.</p> <p>The candidate provided copy of the maintenance log, controlling of documentation log and updated maintenance schedule. It was provided with a basic description that they showed the outcome of the maintenance activity. The candidate did not go into detail about what the individual documents showed.</p> <p>The candidate carried out a brief functional walk through of the system to demonstrate what activity had happened. This was relatively brief and provided only basic commentary on what the candidate did, with little reference to the outcomes and results.</p> <p>The candidate described where changes were made to the maintenance schedule as a result of the peer review feedback. Further reducing of the intervals from 6 months was recommended by one peer but the candidate decided that this was unnecessary and costly.</p> <p>Overall, the handover was adequate, but could have benefited from more attention to detail and thorough explanation when talking about the documents and potential future issues with the system.</p>

Assessor signature	Date
Assessor.1	05/04/2022

## Commentary

The observation record details that the candidate undertook an adequate handover, that reflected the key information to be handed over. For example, the candidate talked through the maintenance that had occurred, what changes they had undertaken to original planned maintenance and with a brief account of the outcomes.

The candidate acknowledged changes made to the planned maintenance schedule with a brief description. The candidate also acknowledged suggestions from the peer review feedback that they chose to dismiss. The response could have been developed further by explaining these in more detail, for example why they decided that more frequent than their suggested 6 monthly intervals would be too costly.

The candidate shared some of the correct technical documentation expected in a handover but could have developed their response further by ensuring that all required documentation was correctly handed over and described in more detail. For example, the test record could have been handed over which would have supported their explanation of work carried out and future recommendations. Some appropriate use of technical and non-technical vocabulary was used, but this could have been more consistent and appropriately directed towards a technical audience.

The handover would have benefitted from being developed further in places, for example, the demonstration of the functional system was noted as being brief. The candidate could have developed their response by providing a walkthrough that provided a more detailed account of the maintenance and explaining the implications of test results on overall system functionality in more detail.

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