HM Government

T-LEVELS

T Level Technical Qualification in Maintenance, Installation and Repair for Engineering and Manufacturing (8712-31)

Maintenance Engineering Technologies: Mechanical (311)

Guide standard exemplification material

Threshold Competence – Sample 2022

City & Guilds

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Introduction

The sample assessment materials within this document refer to the Maintenance engineering technologies: Mechanical 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 the 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 section
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 diagnosing components, assemblies and sub-assemblies to complete maintenance, installation and repair activities, in line with the requirements of the brief.

Demonstrate adequate skills using tools and equipment for mechanical 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 mechanical 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 service and 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
Tools/equipment/materials		
Power supply	1	Power up the milling machine.
Spanner set	1	Different sizes for different jobs on the machine.
Screwdriver set	1	Different types of screwdrivers for different activities.
Plier set	1	To hold items or help with removal.
Allen key set	1	For Allen key fixings.
Measuring implements (D.T.I, Micrometer, Digital callipers, Temp sensors, Rule)	1	To check tolerances, levels and calibration.
Multimeter	1	Conduct electrical tests.
Socket set	1	Remove/refit bolts or nuts.
Torx set and driver	1	Remove/refit Torx bolts/screws.
Pen	1	To complete paperwork.
Spill kit (rags)	1	In case of spilt liquids/fluid.
Funnel	1	Topping up liquids/fluids.
Drill and drill bits	1	In case of needing to remove rivets/bolts.
Spare parts	1	To replace broken or damaged parts.
PPE		
Gloves	1	To reduce chances of injury to hands.
Overalls	1	To protect the body from dirt and solder flux residue.
Safety shoes/boots	1	To reduce chances of injury to feet.
Warning signs and notices		To indicate electrical supplies are isolated.
Technical Information/documentation		
Manuals	For the milling machine.	
Risk assessment	To complete before beginning the task.	
Method statement	To follow during the task.	
Waste disposal	General waste separated, waste fluids in appropriate disposal tanks.	
Time needed	Work area 1 hour Inspect 4 hours Repair 3 hours	

	Return to service 2 hours
Access requirements	None
Fault finding/diagnostic techniques and methods	
Visual inspection	Checking for any visual faults, or components not connected etc.
Input to output	What is expected happens. Operates as expected.
Half split technique	Break the milling machine 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 of the maintenance requirements required for the milling machine.

The candidate has listed amounts of each resource that they have planned to use, however not prepared any spares that may be required if issues arise, listing only one of each replacement component. This demonstrates that time-saving and machine downtime may not have been considered in their planning and preparation.

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 for the task.

The candidate has interpreted the technical information to identify fault finding and diagnostic techniques and methods that are appropriate for the milling machine 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 detail, such as needing heat resistant gloves. To develop this area further, additional pieces could also be listed, including safety glasses and step ladders.

1b. Risk assessment

Risk Assessment				
Hazard	Risk	Control	Likelihood	Severity
Working area throughout the maintenance, servicing and fault finding activities on the milling machine	Slips, trips and falls.	Ensure area is clean and tidy throughout preparation, maintenance and upon completion. Follow MSDS with any spilt liquids. Wear PPE at all times.	1	1
Manual handling of tools and equipment for maintenance activities	Back injury.	Do not lift over maximum lifting limit. Ensure correct training has been received.	1	1
Working with stored electrical energy whilst carrying out maintenance of the milling machine	Impact injuries, electric shock, burns.	Ensure that correct procedures are followed, and all stored energy is safely discharged. Observe cool down periods.	2	2
Burr / metal filings from previous use	Cuts, splinters, infection	Clean off debris and wear appropriate gloves.	5	2
Working with high temperature	Burns/scalds.	Ensure milling machine has cooled down before removing and replacing parts. Do not handle components whilst still hot.	2	2
Using general hand tools and equipment to undertake maintenance and fault finding on the milling machine	Cuts, abrasions, general hand injury.	Ensure proper use of tools and equipment, particularly drills, torx, screwdrivers and pliers. Ensure correct PPE is obtained and worn, such as gloves when working with fluids and safety glasses to protect from flying debris, such as metal fillings.	1	1
Electricity when working with the milling machine	Electrocution.	Safe isolation following ELV guidance.	2	4
Equipment malfunction / faulty components	Issues with machine whilst modifying / installing new parts.	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 milling machine 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. The response could have been developed further by breaking down the activity into specific stages and considering risks and hazards for each stage. For example, when preparing the work area, during maintenance and whilst fault-finding. This would have demonstrated a deeper understanding of risks and hazards associated with the task.

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. For example, wearing gloves at all times especially when working near high built up areas of metal debris/burr to prevent accidental metal ingress into the skin.

The candidate has labelled the likelihood 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/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

- Collect my PPE, tools and equipment that will be needed for the task.
- Put on PPE and visually check the area.
- Remove any objects or items that may cause injury and put out warning signage.
- Adhere to the Health and Safety at work act during all activities.
- Inspect the milling machine visually.
- I will then clean the milling machine down and check connections of equipment and components.
- I will power down the milling machine and lock off the power supply isolating the machine.
- Once the milling machine is switched off, I will remove the lubricating cutting fluid from the machine as part of the maintenance schedule (including a clean of the reservoir) and do the same with the gearbox fluid.
- Replenish fluids and check levels.
- Check spindle for play/end float.
- Check and adjust bed for level.
- Check wires and switches.
- Function and leak test all pumps and motor/s (including pipes). Replace/repair as required.
- Customer complained about longitudinal travel issue, check backlash in both axis leadscrews and adjust to manufacturers spec.
- I will check feed rate.
- I will check that everything is back together correctly and give a general inspection of the milling machine before putting the power back to the machine.
- Once the milling machine is powered back up, I will complete a test run with mild steel.
- I will complete the appropriate stock records to ensure any used stock can be replenished.
- 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/assessor.

Commentary

The method statement is clear and demonstrates basic knowledge and understanding for the maintenance processes and accurate sequencing of tasks. For example, they will undertake initial preparatory steps that start with inspection, cleaning and then powering down and switch-off of the machine. The response could have been developed further with greater detail of what they plan to do at each stage, for example 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 fluid waste disposal and guidance documents, and how they are applied, such as disposing of any fluids in marked containers and for these to be collected from an approved disposal company.

The method statement lists the candidate's proposed actions in a bullet list form which can easily be followed in Task 2. The statement shows an adequate level of planning with consideration of all of the key steps, but these are not always followed in the most optimal order. The response could have been developed further through providing more detail of the intended actions and techniques. For example, when undertaking the checks, the candidate could have stated how the specific checks are made and what measuring equipment is used to determine the result. 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 service and 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 manufacturer's maintenance record 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 service and maintenance activities.

Photographic evidence required:

- Photographic evidence showing the prepared work area - Illustrated in Task 2 photographic evidence section below (photograph 1)

- Photographic evidence showing the condition of the full milling machine prior to any work being carried out – Illustrated in Task 2 photographic evidence section below (photograph 2)

- Photographic evidence showing the milling machine disassembled – Illustrated in Task 2 photographic evidence section below (photographs 3, 4, 5 and 6)

- Photographic evidence showing the working area after disassembly - Illustrated in Task 2 photographic evidence section below (photograph 7)

- Photographic evidence showing the sub-assemblies after repairs have been completed – Illustrated in Task 2 photographic evidence section below (photographs 8, 9 and 10)

- Photographic evidence showing the full milling machine after the maintenance and service has been completed to show final condition and re-instated work area – Illustrated in Task 2 photographic evidence section below (photograph 11)

Candidate evidence

2. Completed test record

Test record sheet - 03/04/2022

Actions completed -

- Planned maintenance and inspection completed.
- Backlash on axis X and Y led to leadscrew replaced.
- Gearbox drain plug replaced.
- Fluids replenished and grease cleaned off and relubricated.

Milling machine was then ready for final testing.

Testing of the milling machine

- Test the PH level of the cutting fluid 9.5pH (no lower than 8.5 is allowed).
- Power supplied back to the milling machine and then powered on.
- Checked that the milling machine was running as expected by milling mild steel.
- Check for leaks now the system has run.
- Once happy, confirmed that the milling machine was in fact up and running and working as it should be.

Testing of the milling machine is now complete, and the milling machine can be handed back over to the supervisor. The next step is to complete the maintenance log with details of work completed and review control 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, testing the most common issues for the machine demonstrating their understanding of the system and maintenance process for it. To further develop the response the candidate could have taken further measurements of additional parameters, such as backlash and DTI readings. Each stage undertaken has been listed but with limited detail on what was undertaken. They have recorded the results of the pH of coolant against the expected results.

The candidate could develop their response further by providing more comprehensive detail of the different steps, including how testing was completed with reference to corresponding remedies and measurements obtained, using more detailed technical terminology.

2. Updated maintenance records and control documents

Maintenance log							
			Milling machine type:	Bridgeport			
			Milling machine TAG number:	1A2B3C			
			Department responsible for equipment:	Maintenance engineering department			
Date:	**Maintenance performed by:**	**Maintenance description:**	**Work completed outside the scope of the maintenance:**	**Are any problems identified rectified? Y/N**	**Validation performed by:**	**Next maintenance due date:**	**Comments:**
03/04/2022	Candidate.A	Scheduled maintenance and intermittent fault diagnosis.	The milling machine was showing signs of gearbox oil leakage. The drain plug was rounded, and leaking item replaced. The maintenance tasks were completed to include the backlash adjustment.	Y		03/04/2022	Planned maintenance completed. Recommend the maintenance schedule is revisited and updated.

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?**	**Any issues with diagrams and specifications to report:**
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 log correctly, information provided is relevant and complete with minimal errors. They have recorded the maintenance carried out including repairing faults with the drain plug and the sealing ring and that these were resolved by the replacement. This shows an understanding of the recording and reporting procedures for future reference in the maintenance process.

To develop the response further, more information and detail could have been recorded on the form. For example, reference to all testing and resolution methods that were required on the milling machine, like that the bed level required a minor adjustment.

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

- Collect my PPE, tools and equipment that will be needed for the task.
- Put on PPE and visually check the area.
- Removing any objects or items that may cause injury and put out warning signage.
- Adhere to the Health and Safety at work act during all activities.
- Inspect the milling machine visually.
- I will then clean the milling machine down and check connections of equipment and components.
- I will power down the milling machine and lock off the power supply isolating the machine.
- Once the milling machine is switched off, I will remove the lubricating cutting fluid from the machine as part of the maintenance schedule (including a clean of the reservoir) and do the same with the gearbox fluid.
- I found a rounded gearbox drain plug.
- Replenish fluids and check levels to include the PH of the cutting fluid.
- Check spindle for play/end float.
- Check and adjust bed for level.
- Check wires and switches.
- Function and leak test all pumps and motor/s (including pipes). Replace/repair as required.
- Customer complained about longitudinal travel issue, check backlash in both axis leadscrews and adjust to manufactures spec. Broken leadscrew found and replaced.
- Dismantle the housing for the worm gearing for both X and Y axis for the table and adjust the backlash to the tolerance as listed in the technical data documentation.
- Grease up the worm gearing of the table.
- I will check feed rate.
- I will check that everything is back together correctly and give a general inspection of the milling machine before putting the power back to the machine.
- Once the milling machine is powered back up, I will complete a test run with mild steel.
- I will complete the appropriate stock records to ensure any used stock can be replenished.
- 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 indicated at what intervals the scope of work changed from their planned method statement with a factual account of what was observed, showing interpretation of the machine and fault detection results as they were working on the machine. To further develop the response, the candidate could have provided further detail and justification of what fault resolution methods were chosen and what detection and diagnosis information led to them.

For example, why they chose to replace the leadscrew and the processes followed to replace this accurately.

2. Practical observation form – work area preparation

Assessment ID	Qualification number
8712-311	8712-31
Candidate name	**Candidate number**
Candidate.A	CG12345
Centre name	**Assessment theme/s**
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.

Task	**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 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. A small toolbox was prepared and placed in the work area but in a way that could have made it a potential obstruction during the work activity. Technical information, including their risk assessment, was collected. This was placed just outside of reach of the work area. The candidate ensured all basic health and safety requirements were followed before the maintenance activities began. Appropriate barrier was used.

Assessor signature	Date
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 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

Assessment ID	**Qualification number**
8712-311	8712-31
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health & 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.

Task	**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.*
Decommissioning, disassembly and inspection	The candidate correctly followed all steps of isolation procedures before starting work on the milling machine. The candidate disassembled the milling machine correctly, referring to the method statement and technical information regularly as an aid. Correct sub-assemblies and components were removed, with components disconnected, and placed onto a work bench. All fluids were drained with consideration to health and safety using a funnel and drain tray, checking fluid levels when replenished. Time was wasted by the candidate by moving from task to task rather than follow a logical sequence.
Fault detection and diagnosis	The candidate completed some visual and physical checks and then addressed the backlash, identifying the issue of the leadscrew. The candidate dismantled the table worm gear correctly and lubricated this up appropriately (with grease). The candidate did not diagnose or rectify the gearbox issue. The candidate moved onto the maintenance process and discovered the excessively worn drain plug. The candidate changed the drain plug. After assembly, the candidate completed a milling machine function check to confirm fault rectification, and so did not complete in a fully logical order or following processes.

Task	**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.*
Reassembly and recommissioning	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 gearing, the milling machine was not working within specified tolerances. The candidate did not recognise the split gearbox O ring seal and there was some fluid leaking after use. The candidate mostly returned tools and equipment to appropriate storage but did not clean down these thoroughly before returning them. The candidate then re-energised the milling machine and completed a test run.
Working area	Worked safely through all activities, following appropriate workshop requirements. Disconnected components were placed on a bench, rather than in containers which could have resulted in a trip hazard if knocked off the bench. Mostly returned tools and equipment to appropriate storage but did not clean down thoroughly. Floor around milling machine had some debris remaining and not fully cleared of obstacles.

Assessor signature	**Date**
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 the table for level before adjusting the leadscrews. The candidate was able to correctly diagnose and resolve two of the four faults within the milling machine.

The candidate set up the datum alignment incorrectly on their first attempt but was able to rectify before proceeding with reassembly. As the candidate had not diagnosed and resolved the faulty feed motor gearing, the milling machine could not be calibrated within the manufacturer's specified tolerances, so although the milling machine was working, it could not produce accurate functions. The candidate could have demonstrated their maintenance ability further by ensuring all areas of the milling machine were fully operational and working to manufacturer specifications before undertaking a full test run.

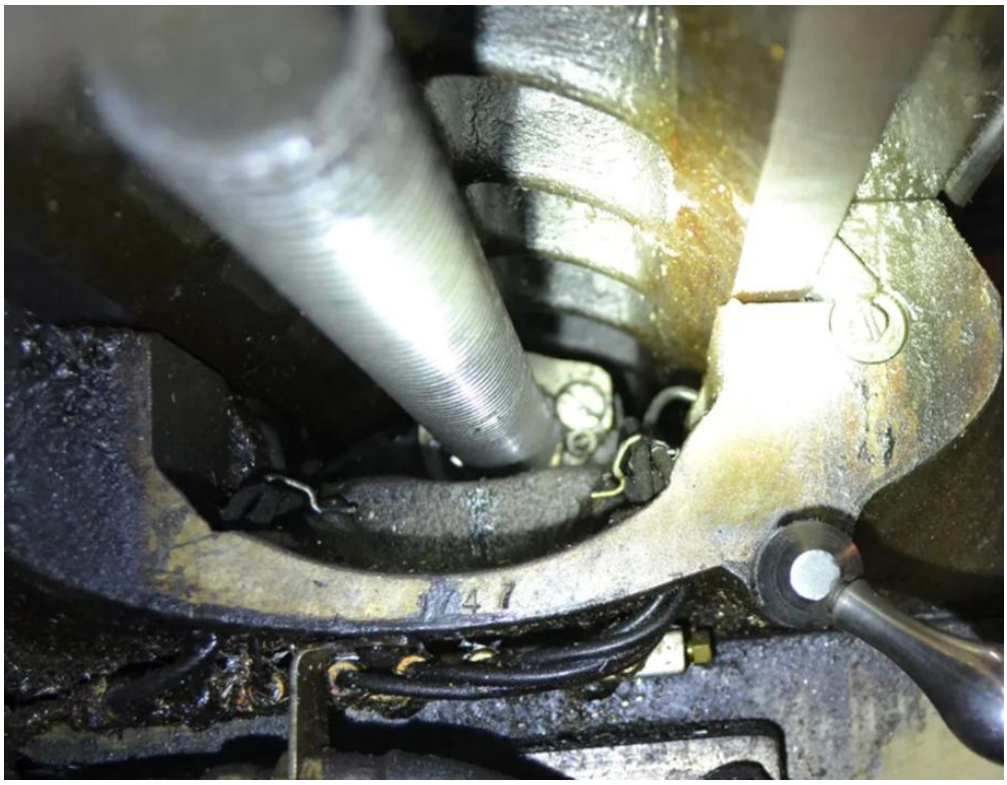
2. Photographic evidence

Photograph 1: Photographic evidence showing the prepared work area, with small toolbox, health and safety guard but no signage. Technical documentation to hand but not in view. Toolbox shown is a potential obstacle.

Photograph 2: Photographic evidence will show the condition of the full milling machine prior to any work being carried out.

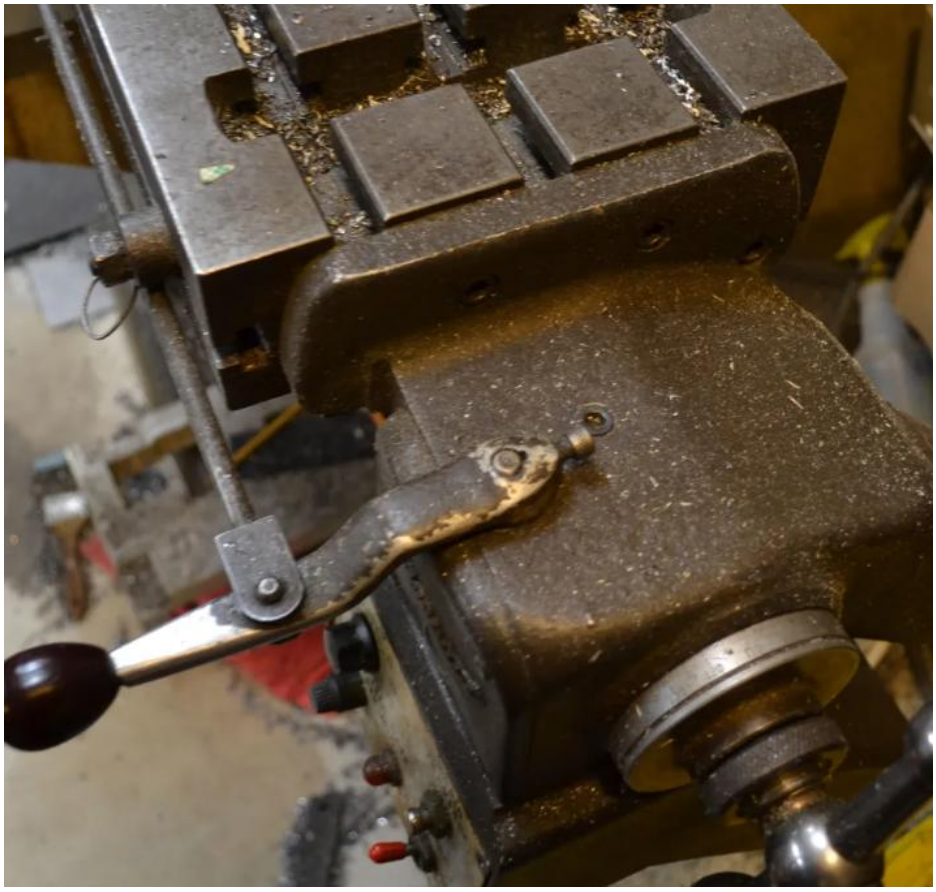
Photographs 3, 4, 5 and 6: Photographic evidence showing the milling machine subassemblies removed before repair.

Photograph 3: Identified lead screw in situ.



Photograph 4: Lead screw removed with working area showing burr, debris and disorganised tools.

Photograph 5: Power feed with burr/debris.



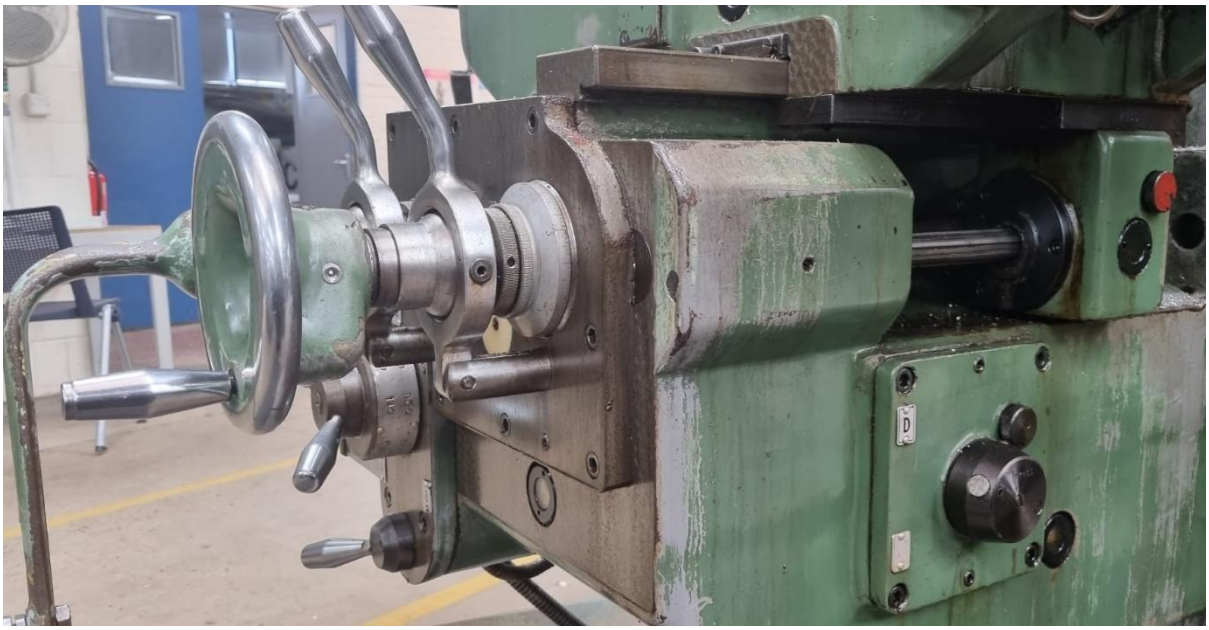
Photograph 6: Power feed removed showing burr has not been cleaned away and tool lying on top.

Photograph 7: Photographic evidence showing the wider working area after disassembly, with parts, components and tools placed on the bench in no logical order. Toolbox remains on the floor a potential trip hazard.

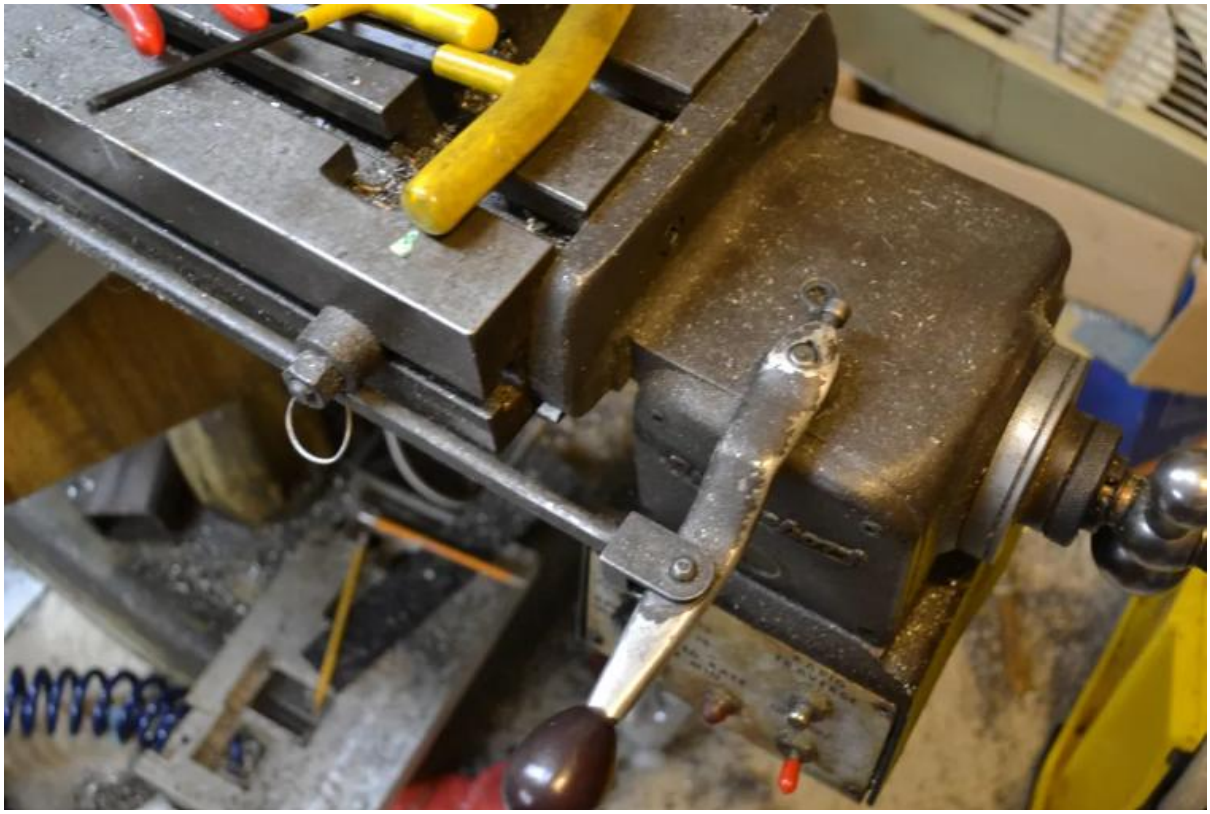
Photographs 8, 9 and 10: Photographic evidence show the sub-assemblies after repairs have been completed. The condition of each sub-assembly following repairs shows an adequate degree and quality of finish, with some areas cleaned and others not.

Photograph 8: Lead screw and nut refitted, and housing has not been swept clean.

Photograph 9: Reassembled feed control wheel, which has been cleaned of burr/debris



Photograph 10: Power feed refitted, working area messy with pencils and debris, top of motor has been swept clean but the rest of the sub-assembly has remaining burr/debris.



Photograph 11: Photographic evidence showing the full milling machine after the maintenance and service has been completed. The machine has been mostly cleaned, the working area shows the debris and items remaining on the floor and not all tools have been returned to appropriate storage.

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

Bridgeport milling machine	04/04/2022
The milling machine needed the scheduled maintenance to be completed. The milling machine to be maintained is used for repetitive milling processes. The milling machine also includes a digital read out which is used to control the milling machine operations. The maintenance included fixing any faults that had been reported or other faults that I may come across during the task. The information required for the task was provided through a brief as well as specifications of the milling machine which were used to check the milling machine was functioning as it should. 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. 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 a visual inspection to visually check the condition of the milling machine and identify any damage or wear and tear to the milling machine. Followed by cleaning out the cutting fluid and replenishing this, checking for leaks or blockages to the pipes. When I looked at the drain plug for the gearbox oil I noticed that this was rounded and that there was a leak. I asked for a new drain plug, this was replaced and tightened to prevent further leaks. I then continued on with the maintenance required, checking the spindle to be within the expected values of tolerance and spinning true – it was fine. I dismantled the milling machine and lubricated the gears with the required grease and oil. I then continued to dismantle to gain access to the leadscrews to adjust the backlash. This was worn excessively (on the x axis), I gained a new leadscrew and fitted it. I then checked that the bed was level and true using an engineer's square, spirit level and feeler gauges. I re-assembled the milling machine 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 (toolbox and tool cupboard) and putting all rubbish in the bin. Stock used was:

- X axis leadscrew
- gearbox drain plug
- gearbox oil
- cutting fluid.

Overall, I managed to complete the maintenance tasks, resulting in a milling machine that operates more effectively. However, the intermittent fault was not found, so I recommend further investigation on the system to find and resolve.

Commentary

The technical report provides a basic technical report 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 milling machine 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 recommended further investigation to resolve the outstanding faults they were unable to identify due to the fault being intermittent. To develop the response further, the candidate could have recommend completing further investigation and measurements with the half split technique with further analysis and interpretation of the results to identify the root cause.

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 gearbox oil and type used, to include what was left in the stock cupboard, then reporting this to the supervisor.

3a. Revised maintenance schedule

Milling machine:	Findings during maintenance:	Recommendations to seniors:	Justification to seniors:	Recommended next planned maintenance due date:
Bridgeport milling machine	Gearbox drain plug rounded and replaced. Worn leadscrew is a wear and tear item, this was broken and replaced.	It is recommended that the milling machine bed is monitored for vibration and reported for further investigation as required. A vibration felt on the bed before work, slight negotiable vibration felt when work completed no further faults found.	Vibration felt on the bed could be caused by faults not yet discovered so investigating further now may avoid faults getting worse and leading to more machine downtime.	02/04/2022 Reactive investigation ASAP

Commentary

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

The candidate has considered the completed planned maintenance and outstanding maintenance issues and produced a basic, but accurate, revised maintenance schedule, demonstrating their basic knowledge and understanding of the maintenance schedule process. The candidate has also identified that further investigation of the vibration felt on the milling machine bed is required needed due to potentially unresolved faults, but not specified exact timescales for this. To develop the response further, the candidate could have identified an appropriate timescale for this investigation to be completed by with justifications of this.

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. Completed peer review forms

Candidate name	**Candidate number**
Candidate.C	34567
Centre name	**Centre number**
ABCDE	12345

Question	**Feedback**
How well does the schedule enable planned maintenance activities to be performed and recorded over time?	*The schedule enables planned maintenance to be continue on a yearly basis which is a typical maintenance schedule, but a long period of time. The documents produced allow for the maintenance to be recorded clearly.*
How appropriate are the recommended planned maintenance intervals and why?	*12 months is a long period of time for the nature of the milling machine when vibration was still noted this could deteriorate and effect finish/quality of final product.*
What are the implications to the business of the proposed maintenance schedule?	*Further investigation recommended but no alteration to the planned maintenance schedule, having to complete ad-hoc reactive maintenance may be more costly to the business due to machine downtime reducing its productivity and efficiency.*
How can the maintenance schedule could be optimised/ improved?	*Where candidate.A has suggested completing further investigation only. I feel that the maintenance should be completed on a 6 monthly milling machine as to prevent faults not being reported and maintain full accuracy of the milling machine. Because the leadscrew was excessively worn, I would also recommend replacing this each time planned maintenance is carried out to avoid this happening again.*

Candidate name	Candidate number
Candidate.D	45678
Centre name	**Centre number**
ABCDE	12345

Question	Feedback
How well does the schedule enable planned maintenance activities to be performed and recorded over time?	*The schedule enables planned maintenance to be completed on a yearly basis which is a commonly used maintenance schedule, but I think is too long for this type of machine that is used so consistently. The documents produced allow for the maintenance to be recorded clearly.*
How appropriate are the recommended planned maintenance intervals and why?	*12 months is a long period of time for the nature of the milling machine and may cause further issues down the line because of the vibration still felt within the machine. Recommending reactive maintenance rather than preventative maintenance may not support the machine to be productive and may cause health and safety issues for the operators as well.*
What are the implications to the business of the proposed maintenance schedule?	*Reactive maintenance will be more costly to the business as this will include increased system downtime than completing more regular planned maintenance activities.*
How can the maintenance schedule could be optimised/ improved?	*Where candidate.A has suggested further investigation, they have not suggested a timescale. Further investigation and resolution should include a timescale to ensure this is completed appropriately. I feel that the maintenance should be completed on a 3 monthly basis due to the nature and consistent use of the machine and would ensure faults are caught early and reduce machine downtime.*

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:
Bridgeport milling machine	Gearbox drain plug rounded and replaced. Worn leadscrew is a wear and tear item, this was broken and replaced.	It is recommended that the milling machine bed is monitored for vibration and reported for further investigation as required. A vibration felt on the bed before work, slight negotiable vibration felt when work completed no further faults found. Upon reviewing of the peer feedback, I recommend that the leadscrew should be replaced at each planned maintenance interval.	Vibration felt on the bed could be caused by faults not yet discovered so investigating further now may avoid faults getting worse and leading to more machine downtime.	02/10/2022 Reactive investigation and resolution to be completed by 18/04/2022
Justification for changes: From peer feedback, it was highlighted that due to outstanding vibration issues identified within the machine, reactive maintenance should state a date for further investigation and resolution to be completed, so I recommend this is completed within two weeks of today's date. Peer review feedback highlighted that maintaining the original schedule intervals of 12 monthly was too long due to the nature and consistent use of the machine, so I am now recommending that planned maintenance is completed every 6 months. It was also recommended because of the diagnosed and resolved issue with the leadscrew, this component should be replaced at each planned maintenance activity to avoid repeated issues with this component as this is a common issue.				

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 completion which will ensure this is recorded correctly and not prolonging system downtime.

The candidate has taken on board elements of peer feedback and implemented changes where they agreed these were appropriate. For example, both peer feedback forms suggested the original 12-month intervals may not be fully appropriate to support the machine and the candidate has taken this on board and decreased the intervals to 6 monthly. This demonstrates their ability to understand and respond to peer feedback received and understanding of the importance of preventative maintenance.

Changes made are not all fully appropriate and may be more costly to complete, for example the leadscrew should not need to be replaced unless found to be faulty in the maintenance carried out.

The candidate has provided basic justifications for the changes made, for example the nature and heavy use of the milling machine supports the change to increase the frequency of planned maintenance activities. Justifications for some changes are not fully correct though as the leadscrew is not necessarily a common fault for this machine. 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 two weeks.

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 handover:

- 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

Milling machine type:	Bridgeport
Milling machine TAG number:	1A2B3C
Department responsible for equipment:	Maintenance engineering department

Date:	**Maintenance performed by:**	**Maintenance description:**	**Work completed outside the scope of the maintenance:**	**Are any problems identified rectified? Y/N**	**Validation performed by:**	**Next maintenance due date:**	**Comments:**
03/04/2022	Candidate.A	Scheduled maintenance and intermittent fault diagnosis.	The milling machine was showing signs of gearbox oil leakage. The drain plug was rounded, and leaking item replaced. The maintenance tasks were completed to include the backlash adjustment.	Y	Assessor. 1	02/10/2022	Planned maintenance has been completed but vibrations felt on the bed so recommend further investigation, which should be completed by 18/04/2022. Maintenance schedule updated.

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.

Revised Maintenance Schedule – Bridgeport Milling Machine				
System:	**Findings during maintenance:**	**Recommendations to seniors:**	**Justification to seniors:**	**Recommended next planned maintenance due date:**
Bridgeport milling machine	Gearbox drain plug rounded and replaced. Worn leadscrew is a wear and tear item, this was broken and replaced.	It is recommended that the milling machine bed is monitored for vibration and reported for further investigation as required. A vibration felt on the bed before work, slight negotiable vibration felt when work completed no further faults found. Upon reviewing of the peer feedback, I recommend that the leadscrew should be replaced at each planned maintenance interval.	Vibration felt on the bed could be caused by faults not yet discovered so investigating further now may avoid faults getting worse and leading to more machine downtime.	02/10/2022 Reactive investigation and resolution to be completed by 18/04/2022
Justification for changes: From peer feedback, it was highlighted that due to outstanding vibration issues identified within the machine, reactive maintenance should state a date for further investigation and resolution to be completed, so I recommend this is completed within two weeks of today's date. Peer review feedback highlighted that maintaining the original schedule intervals of 12 monthly was too long due to the nature and consistent use of the machine, so I am now recommending that planned maintenance is completed every 6 months. It was also recommended because of the diagnosed and resolved issue with the rectifier diode, this component should be replaced at each planned maintenance activity to avoid repeated issues with this component as this is a common issue.				

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 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 good 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

Assessment ID	Qualification number
8712-311	8712-31
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
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.

Task	**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 verbally described the work they completed during the maintenance activity sufficiently, describing issues encountered during their approach to the fault finding. The candidate described the two faults they found during the maintenance activity. The candidate explained that the digital readout was displaying the correct values during the functional walk through of the milling machine. They stated that they could feel an unusual vibration on the bed of the milling machine so recommend further investigation which should be completed by 18/04. The candidate outlined the key points where they had changed their method statement and gave a brief account of why this was necessary. The candidate provided a brief functional walk through of the milling machine in operation. This however contained limited reference to their inspection and test results from the maintenance activity. Technical terminology was used correctly but limited. The candidate described where changes were made to the maintenance schedule as a result of the peer review feedback. They described that one peer recommended reducing the intervals from the original 12 months to 3 months. The candidate decided this was unnecessary and costly, so agreed with the second peer who had suggested 6 monthly intervals instead. The candidate provided copies of some key documents including the maintenance log, controlling of documentation log and updated maintenance schedule. The candidate did not describe these documents in detail, simply providing a superficial overview of the main points, but ensured to obtain a signature.

Task	**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.*
	The candidate demonstrated good communication using some technical terminology appropriate to the audience, but mostly language more appropriate for a non-technical audience, rather than a subject matter expert that they were communicating with. 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 milling machine.

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 their original planning and 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 believed additional testing was unnecessary for future planned maintenance.

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 milling machine 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 machine functionality in more detail.

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