T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Maintenance, Installation and Repair for Engineering and Manufacturing (8712-34)

Maintenance Engineering Technologies: Control and Instrumentation (314)

Guide standard exemplification material

Threshold competence – Sample 2022

First teaching from September 2022
Version 1.1

City & Guilds | eal

Version and date	Change detail	Section
1.1 January 2023	OS title amendment	Front cover

Contents

Introduction

The sample assessment materials within this document refer to the Maintenance Engineering Technologies: Control & Instrumentation 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 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
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 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 control and instrumentation 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 control and instrumentation systems, ensuring that most tolerances and calibrations are in-line with specification.

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

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

Task 1 – Plan and prepare for 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
Tools/equipment/materials		
Power supply	1	Power up the system.
Wireless Network	1	Network required to control the system and for PLC communication.
Transmitter	1	Spare part.
Potentiometer	1	Spare part.
Thermocouple	1	Spare part.
Screwdrivers	3	Different types of screwdrivers for different activities.
Wire cutters	1	Snip wires.
Crimp connectors	4	Connecting the wires.
Crimping tool	1	To make joins between cables.
Pot adjuster	1	To adjust potentiometer.
Wire	4m	Replace any damaged wire in the system.
Temperature bath	1	Apply heat to the system.
Multimeter	1	Conduct electrical tests.
4-20mA loop calibrator	1	To complete calibration.
Laptop	1	Required to control and adjust the system.
PPE		
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.
Technical Information/documentation		
Manuals	For the transmitter and PLC equipment.	
Risk assessment	To complete before beginning the task.	
Method statement	To follow during the task.	
Waste disposal	Wiring and general waste separated.	
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/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.

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 system 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.

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 detail, such as needing heat resistant gloves. 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 on the temperature control system	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	Back injury.	Do not lift over maximum lifting limit. Ensure correct training has been received.	1	1
Working with stored energy (temperature) on the temperature control system	Burns, scalding, injury.	Ensure that correct procedures are followed when working on the system once it is heating up and powered on. Allow sensors to cool before removing.	2	2
Using hand tools and equipment for maintenance and repair activities on the system	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 temperature control system that is a live system	Electrocution.	Safe isolation following ELV guidance.	2	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 work 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.

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.
- Inspect the system visually.
- 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.
- Once the system is switched off, I will remove the transmitter from the temperature sensor to perform the calibration.
- I will complete the as found checks and record these on the calibration sheet. If the transmitter is found to be out of tolerance, I will calibrate the transmitter and check that the new values given are in tolerance.
- I will then disassemble the loop and return the transmitter to the system.
- I will check that everything is wired back up correctly and give a general inspection of the system before putting the power back to the system.
- Once the system is powered back up, I will complete a function check.
- 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. 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 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, when undertaking the 'as found' checks, the candidate could have stated what specific checks they would undertake. 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:

- calibration results
- 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 (photograph 1)

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

- Photographic evidence showing test set up for calibration – illustrated in Task 2 photographic evidence section below (photograph 3)

- Photographic evidence showing the top of the thermocouple to show the wiring of the replaced transmitter, including connections - Illustrated in Task 2 photographic evidence section below (photographs 4 and 5)

- Photographic evidence showing the re-instated work area – Illustrated in Task 2 photographic evidence section below (photograph 6)

Candidate evidence

2. Calibration results

Temperature transmitter

Calibration certificate

Serial Number – X3456	**Unit –** °F/°C	**Transmitter range** – 0-600
Full scale value - 600°C	**Tolerance –** 1.0 %±	**PASS/FAIL -** Pass

AS FOUND RESULTS

Applied temperature	Achieved temperature	Error	In tolerance? (Y/N)
0 °C	1.6 °C	+ 1.6 °C	N
150 °C	156.0 °C	+ 6.0 °C	N
300 °C	305.2 °C	+ 5.2 °C	N
450 °C	456.7 °C	+ 6.7 °C	N
600 °C	609.3 °C	+ 9.3 °C	N

CALIBRATED RESULTS

Applied temperature	Achieved temperature	Error	In tolerance? (Y/N)
0 °C	0.5 °C	+ 0.5 °C	N
150 °C	154.4 °C	+ 4.4 °C	Y
300 °C	304.7 °C	+ 4.7 °C	N
450 °C	456.2 °C	+ 6.2 °C	N
600 °C	604.5 °C	+ 4.5 °C	Y

This calibration record certifies that this temperature transmitter has been calibrated to the required standards.

Print name and signature: *Candidate.A*	**Date:** *03/04/2021*
Secondary name and signature:	**Date:**

Commentary

The candidate completed the calibration certificate with some minor calculus errors although the documentation is valid and complete, showing the candidate understands the calibration and recording process. To develop the response further the candidate would need to ensure all calculations are accurate and investigate inaccuracies further.

The candidate has produced both as found calibration results and after calibration results, although not all readings are within manufacturer's tolerance because of the undiagnosed failed transmitter potentiometer not being rectified.

2. Completed test record

Test record sheet - 03/04/2021

Actions completed -

- The network and connection faults that was found was resolved.
- Planned maintenance completed.
- Transmitter re-installed after calibration.

System was then ready for final testing.

Testing of the system

- Power supplied back to the system and then powered on.
- Checked that the system was running.
- Checked the HMI to ensure that the system was online.
- Once confirmed, it was checked that the input temperature was being displayed on the HMI.
- Once happy, that confirmed that the system was in fact up and running and working as it should be.

Testing of the temperature system 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 control documents.

Commentary

The candidate has completed a basic test record that adequately details the actions taken and testing completed. Each stage undertaken has been listed but with limited detail on what was undertaken. To develop the response further, the candidate could include a comparison of input temperature versus HMI displayed temperature and a more comprehensive report including how testing was completed with appropriate technical terminology.

2. Updated maintenance records and control documents

Maintenance log							
			System type:	Temperature system			
			System 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:**
03/04/2021	Candidate.A	Planned maintenance. Reported HMI showing system offline.	The system was found to be offline. There was no network connection to the system, which was rectified through reconnecting the wi-fi. During the maintenance, the transmitter was found to be out of tolerance, however this could not be brought into tolerance. This will require further investigation.	Y		03/04/2022	Planned maintenance completed, but system could not be calibrated within tolerance. Recommend updating the maintenance schedule and revisiting of the transmitter calibration.

Controlling of documentation and software log					
Date:	**Checking of documentation performed by:**	**Is the software and versions up to date?**	**Are there any issues with the PLC?**	**Are risk assessments in date and applicable to the task?**	**Any issues with diagrams and specifications to report:**
03/04/2021	Candidate.A	Yes.	No issues.	Yes.	No issues found with documents and software.

Commentary

The candidate has filled in the maintenance log and control documentation correctly, information provided is relevant and complete with minimal errors, but is quite basic. To develop the response further, more information and detail could have been recorded on the forms, such as what maintenance was carried out on which part of the system and software version number currently in use.

The candidate has demonstrated the ability to update both the maintenance log and control documentation. The documentation has been infilled with information that is relevant and correct to the candidate's knowledge. The response overall is however relatively basic and does not acknowledge the faults that the candidate failed to identify. For example, the issue with the PLC.

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.
- Remove any objects or items that may cause injury.
- Adhere to the Health and Safety at work act.
- Inspect the system visually.
- I will then clean the system down and check connections of equipment and components.
- *I found a loose connection on the transmitter head and decided that this was probably the issue. I decided to just carry on with the steps and calibrate the transmitter first.*
- *At this point the HMI indicated a fault so I needed to take a look and find out what the issue was.*
- I will power down the system and remove the fuses.
- I will then isolate the system following isolation procedures.
- Once the system is switched off I will remove the transmitter from the temperature sensor to perform the calibration.
- I will complete the as found checks and record these on the calibration sheet. If the transmitter is found to be out of tolerance, I will calibrate the transmitter and check that the new values given are in tolerance.
- I will then disassemble the loop and return the transmitter to the system.
- I will check that everything is wired back up correctly and give a general inspection of the system before putting the power back to the system.
- Once the system is powered back up, I will complete a function check.
- *The fault had cleared from the HMI so this confirmed that the issue had been the disconnected wire from the transmitter head.*
- 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 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 what detection and diagnosis information led to them.

2. Practical observation form – work area preparation

Assessment ID	Qualification number
8712-314	8712-34
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. Visual inspection. Technical information, including their risk assessment, placed within reach of the working area, ensuring all basic health and safety requirements were followed before the maintenance activities began. Appropriate warning signs and barriers used.

Assessor signature	Date
Assessor.1	02/04/2021

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
8712-314	8712-34
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme/s**
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.

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 system. The candidate disassembled the system correctly, referring to method statement and technical information regularly as an aid. A short cool down period of 10 minutes was observed but could have been longer. Correct sub-assemblies and components removed, disconnecting wires and placed onto bench.
Fault detection and diagnosis	The candidate completed some visual and physical checks then addressed the HMI, identifying the issue of the remote monitoring system being offline. The candidate conducted physical checks on connections first without attempting to check the state of the HMI, which could have provided further fault-finding information before proceeding. The HMI could have provided further indication of fault identification, which would have increased efficiency of the fault finding and rectification process. Candidate did not diagnose or rectify the PLC fault or failed transmitter potentiometer.
Resolution and calibration	Candidate moved onto the calibration process before completing a system function check to confirm fault rectification, and so did not complete in a fully logical order or following processes. The candidate obtained and set up the test equipment for the calibration correctly with minor problems, initially connecting the calibrator incorrectly, identifying this and rectifying. The candidate completed the calibration process, but due to not identifying the failed transmitter potentiometer, the system was not working within specified tolerances. The candidate completed the calibration sheet with some errors.

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 wired up the temperature transmitter back to the thermocouple incorrectly to begin with but acknowledged and re-wired upon realisation. Terminations had no nicks on the insulation, but wire stripped slightly too much leaving a small amount of exposed copper. The candidate checked the connections to ensure that they were OK. The candidate then re-energised the system and completed a function check.
Working area	The candidate worked safely through all activities, following appropriate workshop requirements. Disconnected wires and components placed on bench rather than containers which could have resulted in a trip hazard if knocked off the bench. The candidate cleaned and returned tools and equipment to appropriate toolbox but did but place toolbox back to the correct storage area.

Assessor signature	**Date**
Assessor.1	03/04/2021

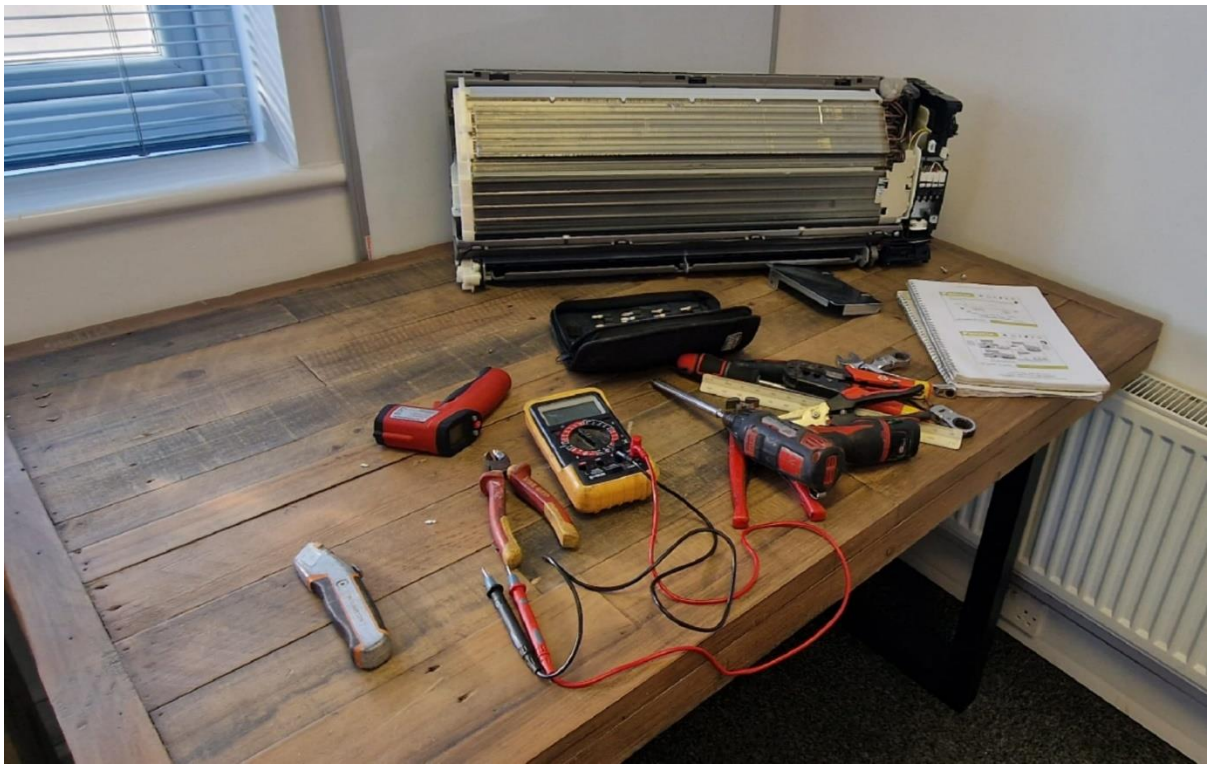
Commentary

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 always completed in the most logical order, for example checking connections before checking the state of the HMI. The candidate was able to correctly diagnose and resolve two of the four faults within the system.

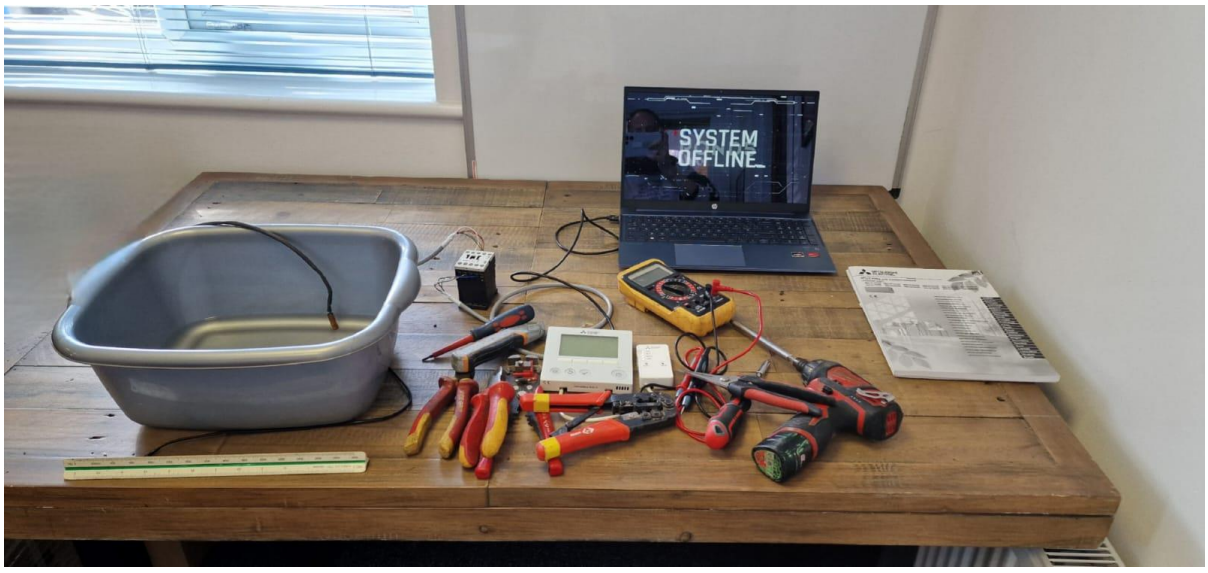
The candidate wired and set up the test and calibration equipment incorrectly on their first attempt but was able to rectify before proceeding with testing. As the candidate had not diagnosed and resolved the failed transmitter potentiometer, the system could not be calibrated within the manufacturer's specified tolerances, so although the system was working, it could not produce accurate outputs. The response could have been further developed by ensuring all areas of the system were fully operational to manufacturer's specification before calibration.

Photographic evidence

Photograph 1: Photographic evidence showing the prepared work area. Tools and equipment have been sourced and placed in the work area, with technical documentation available to hand. The space around the work area has been cleared of obstructions. The work area could have been arranged more clearly, with tools and equipment arranged in a logical sequence.



Photograph 2: Photographic evidence shows the working area after disassembly.



Photograph 3: Photographic evidence showing the test set up for the calibration.

Photographs 4 and 5: Photographic evidence shows the wiring of the thermocouple head to the transmitter. Note, that the terminations show no nicks on the insulation, but the wire is stripped slightly too much leaving a small amount of exposed copper.

Photograph 6: Photographic evidence shows the re-instated working area including the system showing overall condition and working area, tools and equipment tidied away into the toolbox but this has not 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

Temperature system technical report	04/04/2021

The scheduled maintenance of the temperature system was mostly complete, with only some minor issues. Initially the system indicated a fault on the screen of the HMI, which stated 'offline'. Through application of visual and sensory checks, a disconnected wire from the transmitter was found. This could have occurred due to vibration of the process over time which has caused the wire to work loose. The wire was replaced after the calibration. After the completion of the visual and sensory checks, the HMI was further investigated by accessing the interface. It was then that the network and connection issue was identified through further investigation on the HMI. In order to rectify the issue, the HMI was reconnected to the Wi-Fi by inputting the password. The issue with the Wi-Fi may have been caused by the system de-energising, or the router being re-booted, causing the system to disconnect.

The fault detection techniques were appropriate for the system. The visual and sensory application allows for loose wires, burning, overheating and incorrectly placed or installed components to be identified. Using the HMI display to obtain the information that the system was offline is equipment self-diagnostics.

After reviewing the maintenance that was completed and the two issues that have been found, there are no recommendations for the future maintenance steps in particular, however a better approach could have been considered, by checking the HMI for further information first. A maintenance instruction would be beneficial for the scheduled maintenance, which would provide clear steps to follow, including the checking of network and connectivity first, prior to removing sub-assemblies and performing sensory checks. As well as the suggestion of a maintenance instruction, the recommendation of a reduced maintenance schedule would help to improve issues such as the disconnected wire, as all terminals and connections will be checked and tightened more regularly with a reduced schedule, which would be a good preventative measure to further reduce downtime of the system and maintenance engineers spending time fault finding.

Once the fault finding had been completed, during the calibration process it was found that the transmitter could not be brought fully into tolerance. The issue still remains outstanding, and although the system is fully functioning, the displayed measurements are not accurate as a result. As it was not apparent what caused this, the issue is still outstanding and will require further investigation. For the investigation of the fault, it is suggested that unit substitution be carried out, through full replacement of the transmitter.

The stock used included:

- 0.25m red wire
- 0.25m black wire
- crimps.

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

Upon reflection of the task, investigating the HMI in the first instance would have been the most logical approach and would have saved time. The next minor error in the method is that the transmitter should have been reconnected, which would allow the system to be fully function checked before proceeding with the calibration. This could have saved time from calibrating a potentially broken transmitter.

Overall, the scheduled maintenance is appropriate for the system and once the revision to the maintenance schedule has been implemented, the maintenance schedule will then also be appropriate. Future recommendations have been made and the outstanding issue with the transmitter and the inability to trim within tolerance requires further investigation.

Commentary

The technical report provides a basic technical report of the maintenance activities carried out, technical terminology used is correct but limited, for example no reference to the thermocouple, referring to it as temperature sensor instead.

The candidate has reviewed the fault detection and diagnosis techniques they chose to use, considering their appropriateness for the system and cost effectiveness, for example describing why replacing the wiring was the most cost-effective resolution method from the diagnosis. To develop this response further, the candidate could have also reviewed their time management of the activities, acknowledging that their approach to resolution was not in the most logical or efficient order. They have also identified where they are able to improve in their planning for PPE for future, including the use of safety glasses.

The candidate has acknowledged that they completed the calibration process but were unable to trim within manufacturer's tolerance, so they have recommended further investigation to diagnose the issue. Identifying that there needs to be further investigation, the candidate has demonstrated an awareness of an outstanding fault within the system that still needs to be addressed.

The candidate has reported the stock used to complete the maintenance by listing quantities of components and materials used, and how they disposed of their waste. The response could be further developed by noting stock left of each component and materials used 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:
Temperature system	Transmitter disconnected. The transmitter was found to be out of tolerance so needed re calibrated to bring it back into tolerance.	I recommend that the maintenance schedule is looked at, possibly increasing the regularity of the maintenance. Currently 12 months but recommend increasing this to 6 monthly.	The transmitter is constantly in use therefore will often go out of tolerance.	04/10/2021 Further investigation to be carried out ASAP

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 has considered the use of the system and how this will affect the calibration however has not provided any causes or factors that relate to the system which may cause the transmitter to drift and affect its efficiency.

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

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 completed at more regular intervals which will improve system efficiency. The documents produced allow for the maintenance to be recorded clearly.*
How appropriate are the recommended planned maintenance intervals and why?	*The alteration to the maintenance schedule that is proposed is appropriate for the system, however 6 months is still a long period of time for the nature of the system as thermal expansion factors have not been considered.*
What are the implications to the business of the proposed maintenance schedule?	*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.*
How can the maintenance schedule could be optimised/ improved?	*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 prevent the transmitter drifting and maintain full accuracy of the system. I would also recommend re-inputting the PLC program each time planned maintenance is carried out to ensure it is correct.*

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 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, however a reduced schedule should be considered to implement preventative maintenance.*
How appropriate are the recommended planned maintenance intervals and why?	*After reviewing the issues that the system presented during the maintenance, the recommended planned maintenance intervals may not be appropriate.*
What are the implications to the business of the proposed maintenance schedule?	*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.*
How can the maintenance schedule could be optimised/ improved?	*I agree with candidate.A's recommendation to reduce planned maintenance from 12 monthly to 6 monthly, but the cost implications to the business will need to be more thoroughly considered. I would recommend adding a specific timeframe to address the current outstanding maintenance issue rather than stating ASAP.*

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:
Temperature system	Transmitter disconnected. The transmitter was found to be out of tolerance so needed re calibrated to bring it back into tolerance.	I recommend that the maintenance schedule is looked at, possibly increasing the regularity of the maintenance. Currently 12 months but recommend increasing this to 6 monthly. Re-input the PLC program each time planned maintenance is carried out.	The transmitter is constantly in use therefore will often go out of tolerance. Re-inputting the PLC program each time will ensure this is always accurate.	04/10/2021 Further investigation to be completed by 10/04/2021.
Justification for changes: From peer feedback, it was highlighted that due to outstanding issues within the system, reactive maintenance should state a date for further investigation and resolution to be completed, so 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 re-input the PLC program each time planned maintenance is carried out and I agree this would be a good idea to ensure system accuracy.				

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 as well as not prolonging system downtime. This demonstrates their ability to understand and respond 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 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 PLC program should not need to be re-inputted each time planned

maintenance is carried out, this would only be incorrect due to human error if it is inputted incorrectly to begin with. Checking the accuracy of the program would be appropriate, but the candidate's suggestion here would add unnecessary work to the planned maintenance activity.

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

Temperature transmitter

Calibration certificate

Serial Number – X3456	**Unit –** °F/°C	**Transmitter range** – 0-600
Full scale value - 600°C	**Tolerance –** 1.0 %±	**PASS/FAIL -** Pass

AS FOUND RESULTS

Applied temperature	Achieved temperature	Error	In tolerance? (Y/N)
0 °C	1.6 °C	+ 1.6 °C	N
150 °C	156.0 °C	+ 6.0 °C	N
300 °C	305.2 °C	+ 5.2 °C	N
450 °C	456.7 °C	+ 6.7 °C	N
600 °C	609.3 °C	+ 9.3 °C	N

CALIBRATED RESULTS

Applied temperature	Achieved temperature	Error	In tolerance? (Y/N)
0 °C	0.5 °C	+ 0.5 °C	N
150 °C	154.4 °C	+ 4.4 °C	Y
300 °C	304.7 °C	+ 4.7 °C	N
450 °C	456.2 °C	+ 6.2 °C	N
600 °C	604.5 °C	+ 4.5 °C	Y

This calibration record certifies that this temperature transmitter has been calibrated to the required standards.

Print name and signature: Candidate.A	**Date:** 03/04/2021
Secondary name and signature:	**Date:**

Updated maintenance schedule				
System:	**Findings during maintenance:**	**Recommendations to seniors:**	**Justification to seniors:**	**Recommended next planned maintenance due date:**
Temperature system	Transmitter disconnected. The transmitter was found to be out of tolerance so needed re calibrated to bring it back into tolerance.	I recommend that the maintenance schedule is looked at, possibly increasing the regularity of the maintenance. Currently 12 months but recommend increasing this to 6 monthly. Re-input the PLC program each time planned maintenance is carried out.	The transmitter is constantly in use therefore will often go out of tolerance. Re-inputting the PLC program each time will ensure this is always accurate.	04/10/2021. Further investigation to be completed by 10/04/2021.
Justification for changes: From peer feedback, it was highlighted that due to outstanding issues within the system, reactive maintenance should state a date for further investigation and resolution to be completed, so 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 re-input the PLC program each time planned maintenance is carried out and I agree this would be a good idea to ensure system accuracy.				

Maintenance log							
System type: **System TAG number:** **Department responsible for equipment:**				**Temperature system** **12A2B3C** **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:**
03/04/2021	Candidate.A	Planned maintenance	There was a fault that needed fixed.	Y	Assessor.1	04/10/2021	Planned maintenance completed, but system could not be calibrated within tolerance. Further inspection will be needed to investigate the cause of this. Reactive maintenance to be completed by 10/04/2021. Maintenance schedule updated.

Controlling of documentation and software log					
Date:	**Checking of documentation performed by:**	**Is the software and versions up to date?**	**Are there any issues with the PLC?**	**Are risk assessments in date and applicable to the task?**	**Any issues with diagrams and specifications to report:**
03/04/2021	Candidate.A	Yes.	No issues.	Yes.	No issues found with documents and software.

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 did not rectify the syntax errors or obtain a signature from the supervisor on the calibration sheet before handing over, however has demonstrated a good understanding for the process of handing over documentation and adhered to the requirements of the task.

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

Assessment ID	Qualification number
8712-314	8712-34
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 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 they were unable to bring the system into tolerance when completing the calibration process and recommend further investigation to find the cause of this, recommending than that this is completed by 10/04. The candidate provided copies of both the calibration record and maintenance log. These were provided with a basic explanation that they showed the outcome of the maintenance activity. The candidate did not go into detail about what the individual documents showed. It was noted that the candidate had not rectified minor issues with the calibration certificate which had been brought up with the supervisor. 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. 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 additional testing within the planned maintenance activities going forward, but they did not think this was necessary as the system is fully tested already. Further reducing of the intervals from 6 months to 3 months was also recommended but also decided this was unnecessarily and costly.

	The candidate demonstrated good communication using some technical terminology appropriate to the audience, but mostly using 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 system.

Assessor signature	Date
Assessor.1	04/04/2021

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 to their planned future maintenance schedule with a brief rationale as to why.

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 3 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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