End-point assessment plan for Building Energy Management System (BEMS) Controls Engineer apprenticeship standard

Apprenticeship standard reference number	Level of this end point assessment (EPA)	Integrated
ST0629	4	N/A

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Introduction and overview

This document sets out the requirements for end-point assessment (EPA) for the BEMS Controls Engineer apprenticeship standard. It is for end-point assessment organisations (EPAOs) who need to know how EPA for this apprenticeship must operate. It will also be of interest to BEMS Controls Engineer apprentices, their employers and training providers.

Full time apprentices will typically spend 36 months on-programme (before the gateway) working towards the occupational standard, with a minimum of 20% off-the-job training. All apprentices will spend a minimum of 12 months on-programme.

The EPA period should only start, and the EPA be arranged, once the employer is satisfied that the apprentice is deemed to be consistently working at or above the level set out in the occupational standard, all of the pre-requisite gateway requirements for EPA have been met and that they can be evidenced to an EPAO.

All pre-requisites for EPA assessment methods must also be complete and available for the assessor as necessary.

For level 3 apprenticeships and above apprentices without English and mathematics at level 2 must achieve level 2 prior to taking their EPA.

The EPA must be completed within an EPA period typically lasting 6 month(s), beginning when the apprentice has passed the EPA gateway.

The EPA consists of 2 discrete assessment methods.

The individual assessment methods will have the following grades:

Assessment method 1: Project Report and Presentation with Questioning

· Fail
· Pass
· Distinction

Assessment method 2: Practical Observation with Questioning

· Fail
· Pass
· Distinction

Performance in the EPA will determine the overall apprenticeship standard and grade of:

· Fail
· Pass
· Distinction

EPA summary table

On-programme (typically 36 months)	Training to develop the occupation standard's knowledge, skills and behaviours.
End-point Assessment Gateway	• Employer is satisfied the apprentice is consistently working at, or above, the level of the occupational standard. • English/mathematics Level 2 Apprentices must complete: • An agreed project subject, title and scope in conjunction with their employer and the EPAO
End Point Assessment (which would typically take 6 months)	Assessment Method 1: Project Report and Presentation with Questioning With the following grades: · Fail · Pass · Distinction Assessment Method 2: Practical Observation with Questioning With the following grades: · Fail · Pass · Distinction

Length of end-point assessment period:

The EPA must be completed within an EPA period typically lasting 6 month(s), beginning when the apprentice has passed the EPA gateway.

Any supporting material required for the EPA should be submitted at the gateway.

If an EPA assessment method is failed, it should be retaken within the EPA period and in-line with the requirements set out in this assessment plan.

Order of assessment methods

The assessment methods can be delivered in any order.

Gateway

The EPA period should only start once the employer is satisfied that the apprentice is consistently working at or above the level set out in the occupational standard, that is to say they are deemed to have achieved occupational competence. In making this decision, the employer may take advice from the apprentice's training provider(s), but the decision must ultimately be made solely by the employer.

In addition to the employer's confirmation that the apprentice is working at or above the level in the occupational standard, the apprentice must have completed the following gateway requirements prior to beginning EPA:

English and mathematics at level 2.

For those with an education, health and care plan or a legacy statement the apprenticeships English and mathematics minimum requirement is Entry Level 3 and British Sign Language qualification are an alternative to English qualifications for whom this is their primary language.

For Project Report and Presentation with Questioning, the apprentice will be required to submit:

- an agreed project subject, title and scope at gateway to the employer and EPAO.

The Project scope must include:

- 500-word synopsis, completed by the apprentice, including details of the apprentice's role and the relevance of the project to the KSB's assigned to the assessment method
- The timeline for the project
- The date of the proposed submission of the written project

For Practical Observation with Questioning, the apprentice will be required to submit:

N/A

Assessment methods

Assessment Method 1: Project Report and Presentation with Questioning (This Method has 2 components.)

Method 1 Component 1: Project Report

Overview

The Project Report is compiled after the apprentice has gone through the Gateway process.

The work-based project should be designed to ensure that the apprentice's work meets the needs of the business, is relevant to their role and allows the relevant KSBs to be demonstrated for the EPA. Therefore, the project's subject, title and scope will be agreed between the apprentice, employer and the EPAO at the gateway. The employer will ensure it has a real business application and the EPAO will ensure it meets the requirements of the EPA (including suitable coverage of the KSBs assigned to this assessment method). The EPAO should sign-off the project subject, title and scope to confirm its suitability in agreement with the apprentice and employer at the gateway.

The Project scope must include:

- 500-word synopsis, completed by the apprentice, including details of the apprentice's role and the relevance of the project to the KSB's assigned to the assessment method
- The timeline for the project
- The date of the proposed submission of the written project

The rationale for this assessment method is:

The Project will have a factual business application. The project should draw on the work the apprentice is doing, the standard of this work and how they are doing it including how they are approaching the work, dealing with any issues arising and applying any lessons learnt. Given the range and depth of the knowledge criteria being assessed, this method was considered most appropriate as it accommodates the range of environments in which a BEMS Controls Engineer may be working and gives the apprentice the best opportunity to demonstrate their competence.

Delivery

Apprentices will conduct a project, the output of which will be in the form of a report.

The project report is compiled after the apprentice has gone through the Gateway process. The apprentice will conduct their project and submit their report and presentation to the EPAO within 4 months of the EPA start date. The typical duration of the project is 3 months. The employer will ensure the apprentice has sufficient time and the necessary resources, within this period, to plan and undertake the project.

Whilst completing the project, the apprentice should be subject to the supervision arrangements outlined below:

- When the project is submitted, the employer and the apprentice should verify the submitted work is that of the apprentice.

As a minimum all projects must include:

The project must cover the knowledge, skills and behaviours set out in Mapping Section and must be verified by the apprentice's employer that the project is a true reflection of the apprentice's involvement and the report is their own work. The project will be presented as a written report and must include relevant and clearly presented methodology.

The project report must also include the following, as a minimum:

- Background
- Project brief and objectives detailing targets
- Project research
- Project plan
- Implementation – how targets were achieved
- The role the apprentice played, the contribution made and the technical skills used
- Project outcomes
- Challenges faced/lessons learnt by the apprentice

The project report has a word limit of 4,500. A tolerance of plus or minus 10% is allowed.

Appendices, references, diagrams etc. will not be included in this total.

The apprentice must provide supporting evidence relating to the project in appendices. Evidence could include spreadsheets, data reports, build specifications, quality/compliance records or fault reports, pictures or links to video clips. This list is not definitive and other relevant sources are permissible. The appendices must include a mapping of the evidence to the relevant KSBs for this assessment method. It is expected that some evidence may cover multiple KSBs. The appendices must also include a statement from the employer authenticating the apprentice's evidence and achievements.

EPAOs will produce the following material to support this assessment method:

- Outline of the assessment method's requirements
- Marking scheme

Method 1 Component 2: Project Presentation with Questioning

Overview

Apprentices will prepare and deliver a presentation that appropriately covers the KSBs assigned to this method of assessment.

The presentation will be based on the project carried out in component 1 and will cover a summary of the project and report:

- Description as to the scope of the presentation – which engineering project/s or activities are being presented.
- Description of the role of the apprentice in these activities.
- Summary of actions undertaken by the apprentice and outcomes of these activities.
- Achievements, difficulties faced and lessons learned. This presentation requires the apprentice to fully illustrate the KSBs that are mapped to this assessment method.

The independent assessor must review the presentation and Project Report prior to the Presentation with Questioning taking place.

The presentation with questioning will take place at a date, time and location agreed with the employer at least two weeks after submission. This is to allow sufficient time for the EPAO to review the documentation and for the apprentice to prepare

The Project Report and supporting evidence must be available throughout the duration of the Presentation with Questioning components so that it can be referenced by the independent assessor and/or apprentice.

The apprentices can use a range of aids to support the presentation, such as flip charts, video clips, work products/outputs and Power Points.

The presentation will take place:

- At least two weeks after submission but within 6 months of the gateway
- and will be presented to an independent assessor, either face-to-face or via online video conferencing. If using an online platform, EPAOs must ensure appropriate measures are in place to prevent misrepresentation.

The rationale for this assessment method is:

This is a holistic method that will allow some KSBs which may not naturally occur in every workplace or may take too long to observe to be assessed. This method facilitates the assessment of multiple KSBs across a range of duties carried out across engineering activities in the workplace. It is intended that this method of assessment allows the independent assessor to ascertain the competence level of an apprentice against the context of real experiences in the BEMS sector. This component complements the project report component as it allows the apprentice to provide more clarity around the report and the assessor the opportunity to probe and clarify issues.

Delivery

The independent assessors will conduct and assess the Project Presentation with Questioning.

The Presentation with Questioning will last for a total of 60 minutes. This will typically be 30 minutes for the presentation plus a further 30 minutes for questioning. The independent assessor will ask a minimum of 4 questions. The independent assessor has the discretion to increase the time of the

Questioning session by up to 10% to allow the apprentice to complete their last answer. Further time may be granted for apprentices with appropriate needs, in-line with the EPAO's Reasonable Adjustments policy.

During this method, the independent assessor will use the EPAO's question bank and be allowed to generate their own questions based on the evidence in the project to confirm how the presentation demonstrates the relevant knowledge, skills and behaviours.

To deliver the presentation, the apprentice will have access to:

- PowerPoint
- flip chart
- work products
- videos
- computer
- notes

The Presentation and Questioning will be conducted as set out here:

The Presentation with Questioning would normally be conducted face-to-face on a one-to-one basis between the apprentice and the independent assessor. The use of live video conferencing is allowed subject to the controls outlined below.

The independent assessor will make all grading decisions.

The questions and answers are to be recorded either in writing or verbally by the use of a suitable recording device.

The independent assessor must use the assessment tools and procedures that are set by the EPAO to record the Presentation and Questioning.

The independent assessor will make all grading decisions.

Venue

The Presentation and Questioning should take place in a quiet room, free from distractions and influence at:

- employer's premises
- a suitable venue selected by the EPAO (e.g. a training provider's premises)
- a suitable venue for video conferencing for conducting remotely

Other relevant information

A question bank must be developed by EPAOs. The 'question bank' must be of sufficient size to prevent predictability and the EPAO must review it regularly (and at least once a year) to ensure that it,

and its content, are fit for purpose. The questions relating to the underpinning knowledge, skills and behaviours, must be varied yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

Independent assessors must be developed and trained by the EPAO in the observation and assessment of a presentation and the conducting of a questioning session and reaching consistent judgement.

EPAOs will produce the following material to support this assessment method:

- Guidance document for both apprentices and employers as to how the assessment method will be administered, including timescales and deadlines
- Marking scheme
- EPAO question bank

Assessment Method 2: Practical Observation with Questioning

(This Method has 1 component.)

Method 2 Component 1: Practical Observation with Questioning

Overview

Apprentices must be observed by an independent assessor completing work in their normal workplace, in which they will demonstrate the KSBs assigned to this assessment method. The EPAO will arrange for the observation to take place, in consultation with the employer.

One assessor may observe up to a maximum of 1 apprentice at any one time, to allow for quality and rigour.

The rationale for this assessment method is:

The occupation involves practical activity best assessed through observation; it would be difficult to replicate the working environment in a valid way and employers would doubt the occupational competence of an individual not assessed in this way.

Delivery

The observation would typically take 4 hour(s). The observation may be split into discrete sections held over a maximum of 1 working day. The length of a working day is typically considered to be 7.5 hours.

During the observation, the assessor will observe works that enables the apprentice to demonstrate the skills and behaviours required to fulfil the pass and distinction criteria and would normally occur during a typical working day. The works selected will ensure that the assessor can observe the range of activities defined in the mapping of KSB's for this assessment method and will be based upon the activities detailed below so that the employers can ensure that such activities are available on the observation site for all apprentices.

The assessor has the discretion to increase the time of the observation by up to 10% to allow the apprentice to complete a task at the end of this component of the EPA.

In advance of the observation, apprentices must be provided with information on the format of the observation, including timescales.

The following activities MUST be observed during the observation:

- All relevant Health & Safety documentation (e.g. Risk Assessments and Method Statements) associated with work activities to be located and reviewed prior to work commencement.
- Pre-works communication with Building stakeholder (due to the nature of the occupation there will always be some interaction with at least one stakeholder)
- All relevant local health & safety procedures are undertaken as required (e.g. Site inductions, permit to work documents)
- Establish communications with BEMS system using most relevant method
- Software versions to be verified
- BEMS software to be backed up
- BEMS software to be interrogated for operability
- Testing the operation and integration to the BEMS system of an analogue input signal (e.g. Temperature Sensor or Pressure sensor)
- Testing the operation and integration to the BEMS system of a digital input device (e.g. Air or water flow status or plant fault status).
- Testing the operation and integration to the BEMS system of an analogue output device (e.g. Speed, valve or damper actuator)
- Testing the operation and integration to the BEMS system of a digital output device (e.g. Fan or pump Enable)
- Identification of system faults or improvements (where applicable)
- Post works software backup
- Post works Communication with Building stakeholder
- Production of works completion documentation in line with company procedures

The observation should be conducted in the following way, to take account of the occupational context in which the apprentice operates:

Questions may be asked both during and after the observation is complete. The independent assessor will ask a minimum of 4 but can ask up to 12 open questions generated by themselves in order to allow the apprentice to demonstrate their underpinning knowledge, which may not have been observed. They may ask follow up questions where clarification is required. This additional questioning must be included as part of the defined time limit.

KSBs observed, and answers to questions, must be documented by the independent assessor.

The independent assessor will make all grading decisions.

Other relevant information

There may be breaks during the observation to allow the apprentice to move from one location to another as required.

Support material

EPAOs will produce the following material to support this assessment method:

- Outline of the observation's requirements
- Marking materials
- Question bank

Venue

The observation can take place in a real working environment (excluding simulation) which may be located at:

- employer's premises
- premises of a client where appropriate and subject to agreement

Question development

EPAOs will create open questions to assess related underpinning knowledge, skills and behaviours. They must develop 'question banks' of sufficient size to prevent predictability and review them regularly (and at least once a year) to ensure they, and the questions they contain, are fit for purpose. The questions relating to the underpinning knowledge, skills and behaviours, must be varied yet allow assessment of the relevant KSBs.

EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

Independent assessors must be developed and trained by the EPAO in the observation and assessment of a presentation and the conducting of a questioning session and reaching consistent judgement.

Weighting of assessment methods

All assessment methods are weighted equally in their contribution to the overall EPA grade.

Grading

Assessment method 1 Project Report and Presentation with Questioning

KSBs	Fail	Pass	Distinction
K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 K17 K18 K19 **S1 S2 S4 S5 S8 S9 S10 S11 S12 S14 S15 S16** **S18** **B1 B2 B5 B6** **B7**	Does not meet the pass criteria	All pass criteria must be met to achieve the pass grade. Explains building control technologies, theory and the principles of control logic including the fundamentals of proportional and integral control including: • The primary role and function of the control system • The merits of automated control over manual control methods • The development of interface protocols so data can be shared and exchanged between the BEMS and 3rd party systems e.g. access systems and lighting systems. (K1, K19) Explains the fundamentals of controlling HVAC (heating, ventilation and air conditioning) and building technology. (K2) Explains hydrodynamics and hydronic systems in buildings (such as the transfer of energy using water) and its use in cooling systems, heat generation and renewable technology and provides an example of incorporating these into the design process. (K3, K5, S2, S4) Explains thermodynamic relationships in air conditioning systems.	All pass and distinction criteria must be met to achieve the distinction grade. Gives an example of how the application of appropriate controls theory has improved the control and energy efficiency of a building. (K1, K2, K13) Identifies incorrect control Panel wiring, construction and relay logic and provides an example rectification of the issue. (K7) Describes how the varying needs of building stakeholders were incorporated into the BEMS design. (S9) Describes how design documentation is updated following direct feedback from client/ building stakeholder. (S1)

B8 **B9** **B10** **B11** **B12**		(K4) Explains the principles and practices of measurement technology by explaining the operation and application of BEMS field devices and their effects on energy efficiency and comfort control of the building. (K6, K13, K15) Explains examples of Control Panel wiring, construction and relay logic and provides an example of incorporating these into the design process. (K7, S5) Explains the control principles associated with the design, function, facilities management and use of the building and applies the principles to create points lists, description of operation and cable schedules to meet the needs of a variety of building stakeholders. (K8, S1, S9) Explains the use of communications technology protocols and media. (K9) Explains and applies the practices and procedures for the installation of BEMS wiring systems and explains the general characteristics of electrical installations and how to assess them whilst Identifying the requirements for protection of the electrical installation. (K10, K17, S8, S10) Describes the requirements for the BEMS element of electrical installations. (S11) Explains and applies the principles and practices for the commissioning of BEMS and associated equipment in buildings and explains the requirements of inspection and testing of BEMS element of electrical installations and the testing, inspection and	Evaluates and explains the requirements for electrical protection measures applied to a BEMS installation. (K17, S8, S10) Evaluates and explains the process of value engineering in the requirements of BEMS element of electrical engineering (e.g. use of multicore cabling). (S11) Evaluates and explains how the process of commissioning a BEMS installation interacts with or is affected by other site trades or activities (e.g. Water Balancing). (K11, S12) Identifies an alternative solution to correct a fault in a BEMS network or system to prevent future occurrence. (K12)

		certification of BEMS related controls equipment. (K11, K14, K18, S12) Describes the requirements of inspection and testing of BEMS element of electrical installations within relevant legislative requirements, specifications, codes of practice and industry recognised practices. (S16) Describes the principles for diagnosing and correcting faults in BEMS network systems and BEMS equipment in buildings. (K12) Explains the relevant health & safety legislation and safe working practices applying to themselves and others with particular reference to the requirements for protection and safe working with electrical installation and the BEMS impact on wellbeing. (K16) Explains the principles for completing conditional site surveys, along with associated recommendations. (S14) Explains the application of energy efficiency measures to optimise comfort in buildings whilst minimising energy usage. (S15) Explains the needs and concerns of others, especially in relation to diversity and equality. (B1) Explains how to maintain, and enhance productive working relationships by accepting, prioritising, delegating and undertaking technical and other tasks effectively. (B2, B8) Explains how to work independently and solve problems within their own scope of	

		responsibility, by applying technical and behavioural skills and knowledge to define the problem, identify, evaluate and select alternatives and implement solutions and complete the work to the appropriate specifications and codes of practice. (B5, B6) Demonstrates the ability to work with colleagues, clients, the public and other stakeholders in a collaborative, non-confrontational and ethical way, in line with professional competence and conduct. (B9, B11) Explains how they have taken responsibility for personal development, demonstrating commitment to learning and self-improvement. (B10) Explains how to work in a way that contributes to sustainable development. (B12) Applies the principles and practices for the design and commissioning of standard network architectures e.g. Ethernet TCP/IP, MSTP and RS485. (S18) Demonstrates how the candidate has accepted responsibility for their own work and actions and that of others in their team. (B7)	

Assessment method 2: Practical Observation with Questioning

KSBs	Fail	Pass	Distinction
S3 **S6** **S7** **S13** **S17** **S19** **B3** **B4**	Does not meet the pass criteria	All pass criteria must be met to achieve the pass grade. Applies the principles and practices of measurement technology. (S3) Demonstrates the use of communications technology protocols and media e.g. MODBUS and BACNET. (S6) Demonstrates adherence to relevant safety legislation, codes of practice and safe working practices to themselves and others. (S7, B3) Demonstrates the principles, for diagnosing and correcting faults in BEMS network systems and BEMS equipment. (S13) Undertakes the testing, inspection and certification of BEMS related controls and equipment. (S17) Carries out updates to BEMS system hardware to ensure compatibility with latest products. (S19) Demonstrates effective communication with colleagues and clients to communicate technical and other information using oral, written and electronic methods. (B4)	All pass and distinction criteria must be met to achieve the distinction grade. Identifies and proposes a solution for a system improvement. (S3) Evaluates and explains why a particular communication protocol was selected and implemented. (S6) Identifies an alternative method for fault finding on BEMS equipment. (S13)

Overall EPA grading

All EPA methods must be passed for the EPA to be passed overall.

A pass is achieved by meeting ALL pass criteria for each assessment method.

A distinction is achieved by meeting all of the pass criteria and all of the distinction criteria for both assessment methods. Both methods are weighted equally.

Grades from individual assessment methods should be combined in the following way to determine the grade of the EPA as a whole:

Assessment method 1	Assessment method 2	Overall grading
Fail	Any grade	Fail
Any grade	Fail	Fail
Pass	Pass	Pass
Distinction	Pass	Pass
Pass	Distinction	Pass
Distinction	Distinction	Distinction

Roles and responsibilities

Role	Responsibility
Apprentice	• complete the on-programme element of the apprenticeship • prepare for and complete the EPA
Employer	• identify when the apprentice is ready to pass the gateway and undertake their EPA • notify the EPAO that the apprentice has passed the gateway
EPAO	As a minimum EPAOs should: • appoint administrators/invigilators and markers to administer/invigilate and mark the EPA • provide training and CPD to the independent assessors they employ to undertake the EPA

	• have no direct connection with the apprentice, their employer or training provider i.e. there must be no conflict of interest • have processes in place to conduct internal quality assurance and do this on a regular basis • organise standardisation events and activities in accordance with this plan's IQA section • organise and conduct moderation of independent assessors' marking in accordance with this plan • have, and operate, an appeals process
Independent assessor	As a minimum an Independent assessor should: • be independent of the apprentice, their employer and training provider(s) i.e. there must be no conflict of interest • hold or be working towards an independent assessor qualification e.g. A1 and have had training from their EPAO in terms of good assessment practice, operating the assessment tools and grading • have the capability to assess the apprentice at this level • attend the required number of EPAOs standardisation and training events per year (as defined in the IQA section) Plus: ○ Experience of designing, installing, commissioning, servicing and maintaining the range of systems and work activities demonstrated within the BEMS Controls Engineer Apprenticeship Specification. ○ Be recognised as a specialist in BEMS Controls with industry experience supported by a professional CV as verified by the Building Controls Industry Association (BCIA) and must have recent relevant experience either at or above the level of the standard.
Training provider	As a minimum the training provider should: • work with the employer to ensure that the apprentice is given the opportunities to develop the KSBs outlined in the standard and monitor their progress during the on-programme period • advise the employer, upon request, on the apprentice's readiness for EPA prior to the gateway • Plays no part in the EPA itself

Internal Quality Assurance (IQA)

Internal quality assurance refers to the requirements that EPA organisations must have in place to ensure consistent (reliable) and accurate (valid) assessment decisions. EPA organisations for this EPA must:

- appoint independent assessors who have knowledge of the following occupational areas:
    - Experience of designing, installing, commissioning, servicing and maintaining the range of systems and work activities demonstrated within the BEMS Controls Engineer Apprenticeship Specification.
      Be recognised as an experienced specialist in BEMS Controls supported by a professional CV as verified by the Building Controls Industry Association (BCIA) and must have recent relevant experience either at or above the level of the standard.
- provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading
- have robust quality assurance systems and procedures that support fair, reliable and consistent assessment across the organisation and over time.
- operate induction training and standardisation events for independent assessors when they begin working for the EPAO on this standard and before they deliver an updated assessment method for the first time
- assessors must attend a minimum of 1 standardisation activity per year

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Re-sits and re-takes

Apprentices who fail one or more assessment method will be offered the opportunity to take a re-sit or a re-take. A re-sit does not require further learning, whereas a re-take does.

Apprentices should have a supportive action plan to prepare for the re-sit or a re-take. The apprentice's employer will need to agree that either a re-sit or re-take is an appropriate course of action.

An apprentice who fails an assessment method, and therefore the EPA in the first instance, will be required to re-sit or re-take any failed assessment methods only.

The timescales for a re-sit or re-take is to be agreed between the apprentice, employer and EPAO. A re-sit is typically to be within 3 months of the EPA outcome notification. The timescale for a re-take is dependent upon the amount of re-training required but would typically be taken within 4 months of the EPA outcome notification. All assessment methods must be re-taken within a 6 month period, otherwise the entire EPA will need to be re-taken.

Re-sits and re-takes are not offered to apprentices wishing to move from pass to distinction.

Where any assessment method has to be re-sat or re-taken, the apprentice will be awarded a maximum EPA grade of pass, unless the EPAO determines there are exceptional circumstances requiring a re-sit or re-take.

Affordability

Affordability of the EPA will be aided by using at least some of the following practice:

- Using an employer's premises.
- Delivery of the presentation remotely via video conferencing facilities (e.g. Skype)

Professional body recognition

Professional body recognition is not relevant to this occupational apprenticeship.

Reasonable adjustments

The EPAO must have in place clear and fair arrangements for making reasonable adjustments for this apprenticeship standard. This should include how an apprentice qualifies for Reasonable Adjustment and what Reasonable Adjustments will be made. The adjustments must maintain the validity, reliability and integrity of the assessment methods outlined in this assessment plan.

Mapping of knowledge, skills and behaviours (KSBs)

Assessment method 1: Project Report and Presentation with Questioning

Knowledge
K1 Understanding building control technologies and theory including: •The primary role and function of the control system •The merits of automated control over manual control methods •The development of interface protocols so data can be shared and exchanged between the BEMS and 3rd party systems e.g. access systems and lighting systems
K2 Understand the fundamentals of controlling HVAC (heating, ventilation and air conditioning) and building technology
K3 Understand hydrodynamics and hydronic systems in buildings e.g. the transfer of heat energy and cooling energy through a building using water
K4 Understand thermodynamic relationships in air conditioning systems
K5 Understand cooling systems, heat generation and renewable technology
K6 Understand the principles and practices of measurement technology
K7 Understand Control Panel wiring, construction and relay logic
K8 Understand the control principles associated with the design, function, facilities management and use of the building
K9 Understand communications technology protocols and media
K10 Understand the practices and procedures for the installation of BEMS wiring systems
K11 Understand the principles and practices for the commissioning of BEMS and associated equipment in buildings
K12 Understand the principles for diagnosing and correcting faults in BEMS network systems and BEMS equipment in buildings
K13 Understand the energy efficiency and comfort control requirement within buildings
K14 Understand the testing, inspection and certification of BEMS related controls equipment
K15 Understand the operation and application of BEMS field devices e.g. sensors
K16 Understand relevant health & safety legislation and safe working practices applying to themselves and others. Give particular reference to understanding the requirements for protection of and safe working with electrical installations and BEMS impact on 'wellbeing'
K17 Understand the general characteristics of electrical installations and how to assess them
K18 Understand the requirements of inspection and testing of BEMS element of electrical installations

K19 Understand the principles of control logic including the fundamentals of proportional and integral control

Skills
S1 Applying the control principles associated with the design, function and use of buildings e.g. to create points lists, description of operation, cable schedules
S2 Incorporating hydrodynamics/ hydronic systems into designs
S4 Incorporating cooling systems, heat generation and renewable technology into designs as applicable
S5 Incorporating Control Panel wiring, construction and relay logic into the design process
S8 Identifying requirements for protection of electrical installations
S9 Incorporating the needs of a variety of building stakeholders (e.g. owners/ operators) within the design of the BEMS system
S10 Applying the practices and procedures for the installation of BEMS wiring systems
S11 Interpreting the requirements for the BEMS element of electrical installations
S12 Applying the principles and practices for the commissioning of BEMS systems and equipment in a variety of building types and environments
S14 Applying the principles for completing conditional site surveys, along with associated recommendations
S15 Applying knowledge of energy efficiency to optimise comfort in buildings whilst minimising energy usage
S16 Identifying the requirements of inspection and testing of BEMS element of electrical installations within relevant legislative requirements, specifications, codes of practice and industry recognised practices
S18 Applying the principles and practices for the design and commissioning of standard network architectures. E.g. Ethernet TCP/IP, MSTP and RS485

Behaviours
B1 Be aware of the needs and concerns of others, especially in relation to diversity and equality
B2 Create maintain, and enhance productive working relationships
B5 Take responsibility for working independently and completing work to the appropriate specifications and codes of practice
B6 Solving problems within their own scope of responsibility, by applying technical and behavioural skills and knowledge to define the problem, identify, evaluate and select alternatives and implement solutions.
B7 Accepting responsibility for their own work and actions and that of others in their team
B8 Accepting, prioritizing, delegating and undertaking technical and other tasks effectively

B9 Committed to working effectively with colleagues, the public, clients and other stakeholders
B10 Take responsibility for personal development, demonstrating commitment to learning and self-improvement
B11 Exercise responsibilities in an ethical manner
B12 Undertake work in a way that contributes to sustainable development.

Assessment method 2: Practical Observation with Questioning

Skills
S3 Appling the principles and practices of measurement technology
S6 Applying communications technology protocols and media e.g. MODBUS and BACNET
S7 Applying relevant safety legislation, codes of practice and safe working practices to themselves and others
S13 Applying the principles, for diagnosing and correcting faults in BEMS network systems and BEMS equipment
S17 Carrying out the testing, inspection and certification of BEMS related controls and equipment
S19 Carrying out updates to BEMS system hardware to ensure compatibility with latest products.

Behaviours
B3 Commit to compliance with health and safety
B4 Strive to communicate effectively with work colleagues and clients using oral, written and electronic methods to communicate technical and other information.