

End-point assessment plan for Electro-mechanical Engineer apprenticeship standard

| Apprenticeship standard number | Apprenticeship standard level | Integrated end-point assessment |
|--------------------------------|-------------------------------|---------------------------------|
| ST0672 | 6 | No |

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Introduction and overview

This document sets out the requirements for end-point assessment (EPA) for the Electro-mechanical engineer apprenticeship standard. It explains how EPA for this apprenticeship must operate.

It provides the EPA design requirements for end-point assessment organisations (EPAOs) for this apprenticeship standard. It will also be useful for apprentices undertaking this apprenticeship, their employers and training providers.

EPA must be conducted by an EPAO approved to deliver EPA for this apprenticeship standard. Each employer should select an approved EPAO from the Education & Skills Funding Agency's Register of end-point assessment organisations (RoEPAO).

Full-time apprentices will typically spend 60 months on-programme (before the gateway) working towards this occupational standard. All apprentices must spend a minimum of 12 months on-programme. All apprentices must spend a minimum of 20% of on-programme time undertaking off-the-job training.

Before starting EPA, an apprentice must meet the gateway requirements. For this apprenticeship they are:

- the employer must be content that the apprentice is working at or above the occupational standard
- apprentices must have achieved all qualifications mandated in the Electro-mechanical Engineer occupational standard. The qualifications required are:
 - English and mathematics at Level 2¹

¹ For those with an education, health and care plan or a legacy statement, the apprenticeship's English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language.

The EPAO must confirm that all required gateway evidence has been provided and accepted as meeting the gateway requirements. The EPAO is responsible for confirming gateway eligibility. Once this has been confirmed, the EPA period starts.

This EPA should then be completed within an EPA period lasting typically for 5 months.

This EPA consists of 3 discrete assessment methods.

It will be possible to achieve the following grades in each end-point assessment method:

Assessment method 1: Work-based project - comprising of project report, presentation and questioning

- fail
- pass
- distinction

Assessment method 2: Interview underpinned by a portfolio of evidence

- fail
- pass
- distinction

Assessment method 3: Knowledge test

- fail
- pass
- distinction

Performance in the end-point assessment methods will determine the overall apprenticeship standard grade of:

- fail
- pass
- distinction

EPA summary table

| | |
|---|---|
| <p>On-programme (typically 60 months)</p> | <p>Training to develop the knowledge, skills and behaviours (KSBs) of the occupational standard.</p> <p>Training towards English and mathematics Level 2, if required.</p> <p>Compiling a portfolio of evidence.</p> |
| <p>End-point assessment gateway</p> | <p>The employer must be content that the apprentice is working at or above the level of the occupational standard.</p> <p>Apprentices must have achieved all qualifications mandated in the Electro-mechanical engineer occupational standard. The qualifications required are:</p> <ul style="list-style-type: none"> • English and mathematics at Level 2. <p>The employer and apprentice must agree the work-based project title and scope in line with the requirements set out in this plan.</p> <p>Apprentices must submit a portfolio of evidence for the interview. This must be signed by the employer to confirm that this is the apprentice's own work.</p> |
| <p>End-point assessment (typically 5 months)</p> | <p>End-point assessment method 1: Work-based project – comprising of project report, presentation and questioning, graded:</p> <ul style="list-style-type: none"> • fail • pass • distinction <p>End-point assessment method 2: Interview underpinned by a portfolio of evidence, graded:</p> <ul style="list-style-type: none"> • fail • pass • distinction <p>End-point assessment method 3: Knowledge test, graded:</p> <ul style="list-style-type: none"> • fail • pass • distinction |

| | |
|---------------------------------|---|
| | <p>Overall EPA/apprenticeship graded</p> <ul style="list-style-type: none">• fail• pass• distinction |
| Professional recognition | <p>This standard has professional recognition.</p> <p>Bodies: IMechE and RAeS</p> <p>Level: This Apprenticeship Standard aligns with the current edition of the UK Standard for Professional Engineering Competence (UK-SPEC) at Incorporated Engineering (IEng) level. The experience gained and responsibility held by the apprentice on completion of the apprenticeship will either wholly or partially satisfy the requirements for IEng and will reach the agreed level of professional competence as defined in the Assessment Plan.</p> |

Length of EPA period

The EPA will be completed within an EPA period lasting typically for 5 months, starting when the EPAO has confirmed that all gateway requirements have been met.

Order of end-point assessment methods

The end-point assessment methods can be delivered in any order.

The result of one end-point assessment method does not need to be known before starting the next.

Gateway

The apprentice should only enter the gateway once the employer is content that the apprentice is working at or above the occupational standard. 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.

The EPAO determines when all gateway requirements have been met, and the EPA period will only start once the EPAO has confirmed this.

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

- achieved English and mathematics at Level 2.
For those with an education, health and care plan or a legacy statement, the apprenticeship's English and mathematics minimum requirement is Entry Level 3. British Sign Language (BSL) qualifications are an alternative to English qualifications for those who have BSL as their primary language.

For the work-based project comprising of project report, presentation and questioning:

- the employer and apprentice must agree the project title and scope in-line with the requirements set out in this plan

For the interview underpinned by a portfolio of evidence, the apprentice will be required to submit:

- a portfolio of evidence containing evidence to underpin the KSBs mapped to this assessment method. The portfolio of evidence must meet the following requirements:
 - The format and structure of the portfolio need to be agreed between the employer, the apprentice and the EPAO (e.g. hard copy or on-line). However, the content must be sufficient to evidence the apprentice can apply the knowledge, skills and behaviours required as mapped to the interview underpinned by a portfolio of evidence (AM2).
 - There must be at least one piece of evidence relating to each knowledge, skill and behaviour mapped to AM2. One piece of evidence can be referenced against more than one knowledge, skill or behavioural requirement. It is expected that there will be a minimum of 6 pieces and a maximum of 12 pieces of evidence.
 - The portfolio should contain written accounts of activities that have been completed and referenced against the knowledge, skills and behaviours, supported by appropriate evidence, including photographic evidence and work products, such as work instructions, safety documentation, company policies and procedures as appropriate to the activities. Progress review documentation, witness testimonies, and feedback from colleagues and/or clients should also be included. The apprentice's manager/mentor will typically support the development of the portfolio in accordance with company policy and procedures,

- although the end-point assessment organisation will provide further guidance on the content. This is not a definitive list; other evidence sources are allowable.
- The portfolio of evidence should not include any methods of self-assessment. Any employer contributions should focus on direct observation of evidence (for example witness statements) of competence rather than opinions. The evidence provided must be valid and attributable to the apprentice; the portfolio of evidence must contain a statement from the employer confirming this
 - The portfolio of evidence is not assessed but is used to support the interview.

End-point assessment methods

The apprentice will be assessed against the KSBs assigned to the assessment methods outlined below, as shown in the mapping section of this EPA plan.

End-point assessment method 1: Work-based project - comprising of project report, presentation and questioning

Overview

This assessment method has 2 components.

A project involves the apprentice completing a significant and defined piece of work that has a real business benefit. The project must be undertaken after the apprentice has gone through the gateway.

The 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 assessed for the EPA. 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 as shown in the mapping of KSBs. The apprentice and employer must refer to the EPAO's specification and the grading descriptors outlined in this EPA plan to ensure that projects are pitched appropriately.

This assessment method includes 2 components:

- a project with a project output outlined in the project report
- a presentation with question and answers

The rationale for this assessment method is:

- The work-based project is the most valid method as it allows a practical demonstration of occupational competence.
- The project will contribute to the employer's business and be part of the apprentice's everyday work, ensuring that they can demonstrate KSBs in practice.
- Producing a report reflects normal practice in the workplace for an Electro-mechanical engineer so this assessment method is appropriate.
- It is a significant and complex piece of work that thoroughly tests both higher and lower order knowledge and skills as well as behaviours.

Note that it is essential that the project articulates the apprentice's own work practice rather than the activities performed by the team of which they were part.

The independent assessor will review and holistically assess all components of this assessment method.

Component 1 – Project report

Overview

Apprentices will conduct a project which may be based on any of the following:

- a specific problem
- a recurring issue
- an idea/opportunity

Given the large number of projects that will be completed per year, EPAOs will not be expected to sign-off each project title before the project starts. However, the EPAO should instead provide detailed specifications and suggested project titles to enable the employer to select a project that will meet the requirements of the EPA.

Delivery

The project starts after the apprentice has gone through the gateway and must be completed and the project output submitted to the EPAO by the end of week 16 of the EPA period. The employer should ensure the apprentice has sufficient time and the necessary resources within this period, to plan and undertake their project. It is expected that the project itself will equate to 6 weeks of full-time work.

When the project is submitted, the apprentice and their employer must verify that the submitted project output is the apprentice's own work. The apprentice may work as part of a team which could include technical internal support; however, the report will be the apprentice's own work and will be reflective of their own role and contribution.

All projects should be structured to provide the opportunity for apprentices to meet the KSBs mapped to this method of assessment and to produce the required project output. The project output should be in the form of a report (followed by component 2 – presentation and questioning).

As a minimum, all project reports must include:

- a project introduction
- the scope of the project (including key performance indicators)
- a project plan
- project research and findings
- project outcomes and how these outcomes were achieved
- recommendations and project conclusions

The project report has a word count of 6000 words. A tolerance of plus or minus 10% is allowed. Appendices, references, diagrams etc. will not be included in this total. The project report must map, in an appendix, how it evidences the relevant KSBs for this assessment method.

Component 2: Presentation with questions and answers

Overview

Apprentices will be required to produce, submit and present a presentation to the independent assessor.

A copy of the presentation must be submitted to the EPAO at the same time as the project report; 16 weeks after the gateway.

The independent assessor must have a minimum of 2 weeks to review the project report and presentation slides in advance of the presentation itself in order to prepare appropriate questions.

The presentation will provide an overview of the apprentice's project and any project outputs. This will be followed by questioning by the independent assessor.

As a minimum, all presentations must include:

- an overview of the project
- the project scope (including key performance indicators)
- summary of actions undertaken by the apprentice
- project outcomes and how these were achieved

The presentation should require the apprentice to fully demonstrate the KSBs that are mapped to this assessment method.

Delivery

The presentation will be arranged by the EPAO in consultation with the employer. It will be presented to an independent assessor on a one-to-one basis, 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 project report and presentation content must be submitted 2 weeks before the presentation to allow the independent assessor sufficient time to review it and prepare appropriate questions.

The presentation and questioning must last for a total of 60 minutes typically including a presentation of 30 minutes and questioning lasting 30 minutes. The independent assessor has the discretion to increase the total time of the presentation and questioning by up to 10% to allow the apprentice to complete their last point. Further time may be granted for apprentices with additional needs, in-line with the EPAO's Reasonable adjustments policy.

The independent assessor will ask a minimum of 6 questions. Questions may be taken from an EPAO question bank or be those generated by the independent assessor. Follow up questions are permitted where clarification is required.

The purpose of the questions is to allow the independent assessor opportunity to probe the responses provided by the apprentice, and to ensure all of the KSBs mapped to this assessment method are suitably covered and to explore the apprentice's depth and breadth of understanding.

The independent assessor must use the full time available for questioning to allow the apprentice the opportunity to evidence occupational competence at the highest level available, unless the apprentice has already achieved the highest grade available.

Those KSBs that the apprentice did not have the opportunity to demonstrate during the project, product output(s) and/or presentation can instead be covered by questioning, although these should be kept to a minimum.

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

- presentation software
- a copy of the project report and presentation
- notes
- computer

KSBs met and answers to questions, must be recorded by the independent assessor. The independent assessor will make all grading decisions.

Assessment location

The presentation, question and answers can take place in a suitable venue selected by the EPAO (e.g. EPAO or employer premises).

The presentation, question and answers should take place in a quiet room, free from distractions and influence. Video conferencing can also be used to conduct the presentation and questioning component, but the EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

Only the independent assessor will observe the presentation. (A representative from the EPAO may be present when necessary for moderation purposes.)

Question and resource development

Questions must be written by EPAOs, be relevant to the occupation and assess the KSBs mapped to this assessment method. It is recommended that this be done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of their questions when consulting employers.

Each EPAO must develop a test specification. They must also develop a question bank of sufficient size to prevent predictability and review it regularly (at least once a year) to ensure it, and the questions it contains, are fit for purpose.

If the apprentice fails this assessment method, a re-sit should be completed to re-work the initial project report, presentation and questioning. If, however, it is deemed by the EPAO that the project title and scope did not meet their specification, a re-take will be required to determine a new title/scope to re-do the project before creating a re-worked report and presentation. EPAOs must ensure that apprentices have a different set of questions in the case of re-sits/re-takes.

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

- independent assessor assessment materials which include:
 - training materials
 - administration materials
 - moderation and standardisation materials
 - guidance materials
 - grading guidance
- question bank
- guidance documentation for the apprentice and employer

End-point assessment method 2: Interview underpinned by a portfolio of evidence

Overview

This assessment method has one component.

An interview consists of an independent assessor asking an apprentice a series of questions to assess their competence against the KSBs. The independent assessor's role is restricted to asking set questions, and it is not a two-way discussion. Follow-up questions are allowed to help draw out evidence from the apprentice's responses. The independent assessor leads this process to obtain information from the apprentice to enable structured assessment decision-making to occur.

The rationale for this assessment method is:

- it allows the apprentice to be assessed against KSBs that do not naturally occur in the project
- it allows for testing of responses where there are a number of potential answers that require discussion
- it is a cost-effective method for employers, as apart from a venue, it does not require additional resources
- it replicates the sort of discussion occupationally competent employees regularly undertake
- the use of a portfolio allows the apprentice to underpin their responses with evidence

Delivery

The interview must be appropriately structured to draw out the best of the apprentice's competence and cover the KSBs assigned to this assessment method.

The purpose of the questions will be:

- to ensure the apprentice can evidence the KSBs assigned to the assessment method and to provide opportunity for them to show depth and breadth of coverage and, where they are able, to demonstrate the distinction criteria.

The independent assessor will conduct and assess the interview.

The interview must last for 60 minutes. The independent assessor has the discretion to increase the time of the interview by up to 10% to allow the apprentice to complete their last point.

During this assessment method, the independent assessor must refer to the EPAOs question bank. Independent assessors must use the question bank as a source for questioning and are expected to use the portfolio provided by the apprentice at the gateway, and their professional judgement to tailor those questions appropriately. The portfolio will also be used by the

apprentice to refer to in order to exemplify a point. Independent assessors are responsible for generating suitable follow-up questions in line with the EPAO's training and standardisation process. The interview will have a minimum of 6 questions.

KSBs met and answers to questions, must be recorded by the independent assessor. The independent assessor will make all grading decisions.

Assessment location

The interview should take place in a quiet room, free from distractions and influence. Video conferencing can also be used to conduct the interview, but the EPAO must have processes in place to verify the identity of the apprentice and ensure the apprentice is not being aided.

The interview can take place in any of the following:

- employer's premises
- a suitable venue selected by the EPAO (for example a training provider's premises)

Question and resource development

Questions must be written by EPAOs, be relevant to the occupation and assess the KSBs mapped to this assessment method. It is recommended that this be done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of their questions when consulting employers.

Each EPAO must develop a test specification. They must also develop a question bank of sufficient size to prevent predictability and review it regularly (and at least once a year) to ensure it, and the questions it contain, are fit for purpose.

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

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

- independent assessor assessment materials which include:
 - training materials
 - administration materials
 - moderation and standardisation materials
 - guidance materials
 - grading guidance
- question bank
- guidance documentation for the apprentice and employer

End-point assessment method 3: Knowledge test

Overview

This assessment method has two components.

A test is a controlled assessment which consists of a series of questions in which apprentices are asked to provide a response.

The rationale for this assessment method is:

- this method is the most efficient way to test the underpinning knowledge required by electro-mechanical engineers.
- it allows efficient testing of knowledge where there is a wrong or right answer
- it doesn't require independent assessor time, therefore reducing cost

Delivery

Test format

The test can be:

- computer based
- paper based

It will be made up of two parts:

Part a – multiple choice test: This will test theoretical knowledge.

Part b – short answer test: This will test knowledge areas where responses require a calculation, working out to take place or where the question requires more reading time. The open response questions will require an absolute answer, therefore the EPAO will not be required to assess answers against grading descriptors.

Part a:

This will test the following knowledge statements: K6, K7, K10, K11, K13, K17.

It will consist of 30 questions.

The multiple-choice questions will have four options of which one will be correct. The questions must be varied to avoid the test becoming too predictable yet allow assessment of the relevant KSBs.

Test administration

Apprentices must have 75 minutes to complete part a.

The test is closed book which means that the apprentice cannot refer to reference books or materials.

The following equipment is permitted during the test:

- scientific calculator

Part b:

This will test the following knowledge statements: K1, K4, K5, K9.

It will consist of 15 questions.

These questions will consist of scenarios relating to the knowledge mapped to this component and the apprentice will need to work out the correct answer.

Test administration

Apprentices must have 75 minutes to complete part b.

The test is closed book which means that the apprentice cannot refer to reference books or materials.

The following equipment is permitted during the test:

- scientific calculator

Assessment

Tests must be marked by independent assessors or markers employed by the EPAO following a marking guide produced by the EPAO. Alternatively, marking by computer is permissible where questions types allow this.

A correct response will be assigned one mark. No partial credit for partial responses will be awarded.

Any incorrect or missing answers must be assigned zero marks.

Assessment location

Apprentices must take the test in a suitably controlled environment that is a quiet space, free from distractions and influence, in the presence of an invigilator. The invigilator may be another external person employed by the EPAO or specialised (proctor) software, if the test can be taken on-line.

The EPAO is required to have an invigilation policy that will set out how the test is to be carried out. This will include specifying the most appropriate ratio of apprentices to invigilators to best take into account the setting and security required in administering the test.

The EPAO is responsible for ensuring the security of any tests they administer to ensure the test remains valid and reliable (this includes any arrangements made using online tools).

The EPAO is responsible for verifying the identity of the person taking the test. The EPAO must also verify the suitability of the venue for test-taking.

Question and resource development

Questions must be written by EPAOs, be relevant to the occupation and assess the KSBs mapped to this assessment method. It is recommended that this be done in consultation with employers of this occupation. EPAOs should maintain the security and confidentiality of their questions when consulting employers.

Each EPAO must develop a test specification. They must also develop a question bank of sufficient size to prevent predictability and review it regularly (and at least once a year) to ensure it, and the questions it contain, are fit for purpose.

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

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

- Independent assessor assessment materials which include:
 - training materials
 - administration materials
 - moderation and standardisation materials
 - guidance materials
 - grading guidance
 - test specification
 - sample test
 - question bank
- guidance documentation for the apprentice and employer

Reasonable adjustments

The EPAO must have in place clear and fair arrangements for making reasonable adjustments to the assessment methods for the EPA 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 EPA plan.

Overall EPA grading

For assessment methods 1 and 2, see mapping and grading tables later within this document.

Assessment method 3: Knowledge test

Part a:

| KSBs |
|----------------------------|
| K6, K7, K10, K11, K13, K17 |

Part b:

| KSBs |
|----------------|
| K1, K4, K5, K9 |

The following grade boundaries apply to part a:

| Grade | Minimum score (marks out of 30) | Maximum score (marks out of 30) |
|--------------------|---------------------------------|---------------------------------|
| Distinction | 26 | 30 |
| Pass | 16 | 25 |
| Fail | 0 | 15 |

The following grade boundaries apply to part b:

| Grade | Minimum score (marks out of 15) | Maximum score (marks out of 15) |
|--------------------|---------------------------------|---------------------------------|
| Distinction | 13 | 15 |
| Pass | 8 | 12 |
| Fail | 0 | 7 |

The following grade boundaries apply to the overall knowledge test:

In order to obtain an overall pass, both parts must be passed.

In order to be awarded an overall distinction, there must be a distinction in both parts.

| Knowledge Test Overall Grade | Part a | Part b |
|------------------------------|-------------|-------------|
| Distinction | Distinction | Distinction |
| Pass | Pass | Pass |
| Fail | Fail | Any Grade |
| Fail | Any Grade | Fail |

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

Performance in the EPA will determine the apprenticeship grade of fail, pass or distinction.

Independent assessors must individually grade each assessment method, according to the requirements set out in this plan.

EPAOs must combine the individual assessment method grades to determine the overall EPA grade.

Apprentices who fail one or more assessment method will be awarded an overall EPA 'fail'.

In order to gain an overall EPA 'pass', apprentices must achieve a pass in all the assessment methods.

In order to achieve an overall EPA 'distinction', apprentices must achieve a pass in all of the assessment methods and a distinction in at least 2 of them.

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 | Assessment method 3 | Overall grading |
|---------------------|---------------------|---------------------|-----------------|
| Fail | Any Grade | Any grade | Fail |
| Any grade | Fail | Any grade | Fail |
| Any grade | Any grade | Fail | Fail |
| Pass | Pass | Pass | Pass |
| Distinction | Pass | Pass | Pass |
| Pass | Distinction | Pass | Pass |
| Pass | Pass | Distinction | Pass |
| Distinction | Distinction | Pass | Distinction |
| Pass | Distinction | Distinction | Distinction |
| Distinction | Pass | Distinction | Distinction |
| Distinction | Distinction | Distinction | Distinction |

Any grade = fail, pass or distinction

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 at the employer's discretion. The apprentice's employer will need to agree that either a re-sit or re-take is an appropriate course of action.

A re-sit does not require further learning, whereas a re-take does.

Apprentices should have a supportive action plan to prepare for a re-sit or a re-take.

The timescales for a re-sit/re-take is agreed between the employer and EPAO. A re-sit is typically taken within 2 months of the EPA outcome notification. The timescale for a re-take is dependent on how much re-training is required and is typically taken within 3 months of the EPA outcome notification.

All assessment methods must be taken within a 6-month period, otherwise the entire EPA will need to be re-sat/re-taken.

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

Where any assessment method has to be re-sat or re-taken, the apprentice will be awarded a maximum EPA grade of distinction.

Roles and responsibilities

| Role | Responsibility |
|------------|--|
| Apprentice | <p>As a minimum, apprentices should:</p> <ul style="list-style-type: none"> • participate in and complete on-programme training to meet the KSBs as outlined in the occupational standard for a minimum of 12 months • undertake 20% off-the-job training as arranged by the employer and training provider • understand the purpose and importance of EPA • undertake the EPA including meeting all gateway requirements |
| Employer | <p>As a minimum, employers should:</p> <ul style="list-style-type: none"> • select the EPAO and training provider • work with the training provider (where applicable) to support the apprentice in the workplace and to provide the opportunities for the apprentice to develop the KSBs • arrange and support a minimum of 20% off-the-job training to be undertaken by the apprentice • decide when the apprentice is working at or above the occupational standard and so is ready for EPA • ensure that all supporting evidence required at the gateway is submitted in accordance with this EPA plan • remain independent from the delivery of the EPA • confirm arrangements with the EPAO for the EPA (who, when, where) in a timely manner (including providing access to any employer-specific documentation as required, for example company policies) • ensure that the EPA is scheduled with the EPAO for a date and time which allow appropriate opportunity for the KSBs to be met • ensure the apprentice is well prepared for the EPA • ensure the apprentice is given sufficient time away from regular duties to prepare for and complete all post-gateway elements of the EPA, and that any required supervision during this time (as stated within this EPA plan) is in place |

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| | <ul style="list-style-type: none"> • where the apprentice is assessed in the workplace, ensure that the apprentice has access to the resources used on a daily basis • pass the certificate to the apprentice |
| EPAO | <p>As a minimum, EPAOs should:</p> <ul style="list-style-type: none"> • conform to the requirements of this EPA plan and deliver its requirements in a timely manner • conform to the requirements of the Register of End-Point Assessment Organisations (RoEPAO) • conform to the requirements of the external quality assurance provider (EQAP) for this apprenticeship standard • understand the occupational standard • make all necessary contractual arrangements, including agreeing the price of the EPA • develop and produce assessment materials including specifications and marking materials (for example mark schemes, practice materials, training material) • appoint suitably qualified and competent independent assessors • appoint administrators (and invigilators where required) to administer the EPA as appropriate • provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading • provide adequate information, advice and guidance documentation to enable apprentices, employers and training providers to prepare for the EPA • arrange for the EPA to take place, in consultation with the employer • where the apprentice is not assessed in the workplace, ensure that the apprentice has access to the required resources and liaise with the employer to agree this if necessary • develop and provide appropriate assessment recording documentation to ensure a clear and auditable process is in place for providing assessment decisions and feedback to all relevant stakeholders • have no direct connection with the apprentice, their employer or training provider. In all instances, including when the EPAO is the training provider (i.e. HEI), there must be no conflict of interest |

| | |
|----------------------|--|
| | <ul style="list-style-type: none"> • have policies and procedures for internal quality assurance (IQA), and maintain records of regular and robust IQA activity and moderation for external quality assurance (EQA) purposes • deliver induction training for independent assessors, and for invigilators and/or markers (where used) • undertake standardisation activity on this apprenticeship standard for all independent assessors before they conduct an EPA for the first time, if the EPA is updated and periodically as appropriate (a minimum of annually) • manage invigilation of apprentices in order to maintain security of the assessment in line with the EPAO's malpractice policy • verify the identity of the apprentice being assessed • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard • provide details of the independent assessor's name and contact details to the employer • have and apply appropriately an EPA appeals process • request certification via the Apprenticeship Service upon successful achievement of the EPA |
| Independent assessor | <p>As a minimum, independent assessors should:</p> <ul style="list-style-type: none"> • have the competence to assess the apprentice at this level and hold any required qualifications and experience in line with the requirements of the independent assessor as detailed in the IQA section of this EPA plan • understand the occupational standard and the requirements of this EPA • have, maintain and be able to evidence up-to-date knowledge and expertise of the subject matter • deliver the end-point assessment in-line with the EPA plan • comply with the IQA requirements of the EPAO • have no direct connection or conflict of interest with the apprentice, their employer or training provider; in all instances, including when the EPAO is the training provider (i.e. HEI) • attend induction training • attend standardisation events when they begin working for the EPAO, before they conduct an EPA for the first time and a minimum of annually on this apprenticeship standard |

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| | <ul style="list-style-type: none"> • assess each assessment method, as determined by the EPA plan, and without extending the EPA unnecessarily • assess against the KSBs assigned to each assessment method, as shown in the mapping of assessment methods and as determined by the EPAO, and without extending the EPA unnecessarily • make all grading decisions • record and report all assessment outcome decisions, for each apprentice, following instructions and using assessment recording documentation provided by the EPAO, in a timely manner • use language in the development and delivery of the EPA that is appropriate to the level of the occupational standard • mark open (constructed) test answers accurately according to the EPAO's mark scheme and procedures |
| Training provider | <p>As a minimum, training providers should:</p> <ul style="list-style-type: none"> • work with the employer and support the apprentice during the off-the-job training to provide the opportunities to develop the knowledge, skills and behaviours as listed in the occupational standard • conduct training covering any knowledge, skill or behaviour requirement agreed as part of the Commitment Statement (often known as the Individual Learning Plan). • monitor the apprentice's progress during any training provider led on-programme learning • advise the employer, upon request, on the apprentice's readiness for EPA • remain independent from delivery of the EPA. Where the training provider is the EPA (i.e. a HEI) there must be procedures in place to mitigate against any conflict of interest |
| Invigilator | <p>As a minimum, invigilators should:</p> <ul style="list-style-type: none"> • attend induction training as directed by the EPAO • have no direct connection or conflict of interest with the apprentice, their employer or training provider; in all instances, including when the EPAO is the training provider (i.e. HEI) • invigilate and supervise apprentices during tests and in breaks during assessment methods to prevent malpractice in accordance with the EPAO's invigilation procedures |

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| Marker | <p>As a minimum, markers should:</p> <ul style="list-style-type: none"> • attend induction training • have no direct connection or conflict of interest with the apprentice, their employer or training provider in all instances including when the EPAO is the training provider (i.e. HEI) • mark multiple-choice test answers accurately according to the EPAO's mark scheme and procedures |
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Internal Quality Assurance (IQA)

Internal quality assurance refers to the strategies, policies and procedures that EPAOs must have in place to ensure valid, consistent and reliable end-point assessment decisions. EPAOs for this EPA must adhere to all requirements within the Roles and Responsibilities section and:

- have effective and rigorous quality assurance systems and procedures that ensure fair, reliable and consistent assessment across employers, places, times and independent assessors
- appoint independent assessors who are competent to deliver the end-point assessment and who:
 - have recent relevant experience of the occupation/sector to at least occupational level gained in the last 3 years or significant experience of the occupation/sector
- operate induction training for independent assessors and any other personnel involved in the delivery and or/assessment of the EPA (e.g. markers and invigilators)
- provide training for independent assessors in terms of good assessment practice, operating the assessment tools and grading
- where appropriate provide ongoing training for markers and invigilators
- provide standardisation activity for this apprenticeship standard for all independent assessors:
 - before they conduct an EPA for the first time
 - if the EPA is updated
 - periodically as appropriate (a minimum of annually)
- conduct effective moderation of assessment decisions and grades
- conduct appeals where required, according to the EPAO's appeals procedure, reviewing and making final decisions on assessment decisions and grades

Value for money

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

- use of technology – for example video conferencing where applicable
- location – for example use of employer premises
- making maximum use of each typical 7.5 hour working day
- observation of naturally occurring evidence in the workplace

Professional body recognition

This apprenticeship standard is designed to prepare successful apprentices to meet the requirements for registration as an Incorporated Engineer (IEng) with the IMechE or Royal Aeronautical Society.

The experience gained and responsibility held by the apprentice on completion of the apprenticeship standard will either wholly or partially satisfy the requirements for registration with the professional body. For more details on the requirements and application process, please contact the professional body directly.

Mapping of knowledge, skills and behaviours (KSBs)

Assessment method 1: Work-based project

| Knowledge |
|---|
| K2: Engineering design: the creative design process including defining the problem, creating ideas and testing the solution using tools to support the process such as root cause analysis, requirements definition, research and development, solution generation, prototyping, simulation, benchmarking and testing. |
| K14: Project management: project planning, management of risks, commercial awareness (costs, overheads, gross margin, net margin, profit, cash), resourcing and quality assurance. |
| K15: Safety requirements: statutory, organisational and environmental. |
| K16: Computer-aided design: 2D and 3D CAD using software packages. |
| Skills |
| S2: Follow a methodical approach to engineering problem solving. |
| S3: Establish and report engineering design briefs. |
| S4: Produce mechanical and electrical designs / drawings / sketches using Computer Aided Design (CAD) and manual systems. |
| S6: Select the design solution for a given electro-mechanical engineering application and environment using data to inform their decisions. |
| S7: Integrate electrical and mechanical engineering systems, considering new and emerging technologies. |
| S8: Use appropriate equipment to develop and execute test plans to support electro-mechanical product validation and approval. |
| S12: Assemble, wire, program and test electrical equipment, motors and control systems. |
| S13: Plan manage and lead engineering projects. |
| S14: Perform risk management for engineering activities. |
| S15: Comply with statutory and organisational safety requirements. |
| Behaviours |
| B3: Communicate confidently to create and maintain working relationships. Be respectful. |
| B4: Work collaboratively as a team player. Able to work effectively within a team and interacts with / helps others when required. |

B5: Prioritise quality. Follow rules, procedures and principles in ensuring work completed is fit for purpose and pays attention to detail / error checks throughout activities.

B8: Respect the environment and the public good. Consider the adverse effects of projects and tasks on the wider world, in the short and longer term.

Assessment method 2: Interview underpinned by a portfolio of evidence

Knowledge

K3: Systems design: the system lifecycle from concept to disposal, requirements validation and verification, architecture definition, sub-system design and testing, integration, design for supportability/maintainability, functional safety, cyber vulnerability and secure data handling.

K8: Electrical and electronic engineering: theory and design of equipment and systems which use electricity and electromagnetism the fundamental laws and theorems that govern electronic circuits, function of common digital and analogue electronic devices, passive circuit behaviour, modelling circuits, active electronic components, transformers, AC/DC, power electronics, motors and drives.

K12: Structured software, coding and automation: how to create and use computer programming applied to engineering systems, including real-time applications and automated control. Data handling considerations (including data protection and encryption), data analytics and introduction to machine learning.

Skills

S1: Communicate technical information with others at all levels, including technical reports and the use of digital tools.

S5: Model real-world mechanical systems efficiently.

S9: Design functional electronic systems and circuits from component level.

S10: Write and document structured programming code for electro-mechanical systems.

S11: Fabricate engineering components and assemblies using specialist manufacturing methods and hand fitting techniques.

Behaviours

B1: Hold paramount the health and safety of themselves and others, and models health and safety conscious behaviour.

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| B2: Self-motivated, works independently and takes responsibility for their actions. Sets themselves challenging personal targets and makes own decisions. |
| B6: Adjust to different conditions, technologies, situations and environments and to new and emerging technologies. |
| B7: Exercise responsibilities in an ethical manner, with openness, fairness and honesty. |
| B9: Commit to personal learning and professional development. |
| B10: Commit to professional standards (or codes of conduct) of their employer and the wider industry. |

Assessment method 3: Knowledge test

| Knowledge |
|---|
| K1: Mathematics: the mathematical techniques and methods required to model mechanical and electrical systems: algebra, calculus, geometry, trigonometry, statistics. |
| K4: Mechanics: the fundamental laws of static and dynamic classical mechanics and their application to mechanical systems: force and moment systems, free body diagrams, equilibrium, friction, beam theory, hydrostatics, kinematics, Work-Energy and Impulse-Momentum methods, vector algebra, scalar and graphical approaches. |
| K5: Structures: analysis and modelling for the determination of the effects of loads on physical structures, mechanisms, and their associated components: static and fatigue stress, structural failure modes, safe-life and fail-safe design, finite element analysis. |
| K6: Materials: the main classes of engineering materials and their associated mechanical, electrical and environmental properties. How to select appropriate materials to achieve manufacturing and design goals. Thermal treatments and coatings. How to use software to model material properties and behaviour, analysis of experimental results. Avoidance, use and disposal of harmful materials according to appropriate environmental regulations. |
| K7: Thermodynamics: core thermodynamic concepts, system types and the application to engineering systems: basic power cycles and their thermodynamic analysis (steam, gas turbine and reciprocating internal combustion engine), modern power plants (including refrigeration and heat pump plant). |
| K9: Control & instrumentation: theoretical and practical aspects of analogue and digital control system design and tuning to meet performance objectives: transducer systems and operation, measurement applications and error, principles of closed loop control systems and feedback strategies; block diagrams, root-loci, bode diagrams, nyquist plots; methodologies of classical control with applications to electrical, mechanical and mechatronics systems. |

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| K10: Digital and embedded systems: embedded systems and their development, number systems, boolean algebra, logic gates, logic expressions, combinational logic, A/D and D/A converters, computer/microcomputer systems and architectures. |
| K11: Sensors, actuators and mechanisms: linear mechanisms (springs, levers, links, pulleys), rotational mechanisms (universal joints, gears and cams), energy storage and controlled release mechanisms. Sensor types, transfer and environmental characteristics, sensor signal conditioning and processing, digital data acquisition, sensor integration into embedded systems, transmission and receipt of sensor data. |
| K13: Manufacturing: the considerations when turning raw materials into a finished product in the most efficient way possible: common methods and models for the manufacturing process, design for manufacture, production drawings, quality control. |
| K17: Fluid dynamics: different fluid flow types and the application to turbo machinery and hydraulics: laminar and turbulent flow, boundary conditions, drag and friction, compressible flow. |

Grading Descriptors

End-point assessment method 1: Work-based project

| KSBs | Pass | Distinction |
|---|--|---|
| Engineering Design Process: K2, S2, S3, S6 | Writes a design brief to outline the problem and the design requirements. Generates ideas using a range of techniques. Investigates potential solutions by testing ideas. (K2, S2, S3) Makes informed decisions based on qualitative and quantitative data. (S6) | Critically evaluates their engineering design brief and evaluates potential alternative approaches to design strategy and solutions. Provides reasoned arguments for approach taken. (S2, S3) |
| Project Management: K14, S13, S14 | Plans, manages and leads the project to meet the technical and commercial needs of the business. Meets quality requirements in line with the design brief. Uses a range of project management tools to successfully plan tasks, track progress, manage resources and determine pinch points in the critical path. (K14, S13) | Thinks ahead to critically analyse potential contingencies to mitigate the effects of forecast problems and incorporates them into the project plan. (K14, S14) |

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| | Recognises, logs and manages technical and commercial risks using risk management tools. (K14, S14) | |
| Design and electro-mechanical integration: K16, S4, S7, S8, S12, B5, B8 | <p>Produces mechanical and electrical designs / drawings / sketches using 2D and 3D Computer Aided Design (CAD) and manual systems to support the design solution. (S4)</p> <p>Selects a design solution that satisfies the design brief. (S6)</p> <p>Considers the impact of the project on the environment and the public good and takes steps to minimise any adverse effects. (S6, B8)</p> <p>Integrates electrical and mechanical engineering systems, considering new and emerging technologies and ensured work was checked for errors and satisfies the design brief. (S7, B5)</p> <p>Assembles, wires, programs and tests electrical equipment, motors and control systems to specification. Uses appropriate equipment to develop and execute test plans to support electro-mechanical product validation and approval. (S8, S12)</p> | <p>Critically evaluates the integration of electrical and mechanical systems in the selected design solution. (S7)</p> <p>Justifies their design choices taking consideration of competing factors such as quality, cost and the environment. (S6, S7, S8)</p> <p>Selects a design solution that exceeds the design specification. (S7, B5)</p> |
| Communication and teamwork: B3, B4 | <p>Communicates information appropriate to the audience using verbal and written methods. (B3)</p> <p>Works independently and as part of a team as required to take responsibility within their remit. Is inclusive in their approach. (B4, B3)</p> <p>Supports less experienced/less able team members as required, to develop individuals, keeping the project on track. (B4)</p> | |

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| Health and Safety: K15, S15 | Complies with statutory, organisational and environmental safety requirements. Follows organisational procedures for health and safety. (S15) | |
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End-point assessment method 2: Interview underpinned by a portfolio of evidence

| KSBs | Pass | Distinction |
|---|---|---|
| Structured software programming: K12, S10 | Explains how they write and document a structured programming code to automate an electro-mechanical system, with reference to real time applications, data handling considerations (including data protection and encryption), data analytics and machine learning. (K12, S10) | Evaluates the approach taken and proposes improvement or alternative approaches. (S10) Explains how they have written an automated code to perform multiple steps efficiently. (S10) |
| Design and fabrication: K3, K8, S5, S9, S11, B1, B6 | Explains how they apply their knowledge of the system lifecycle to design electromechanical systems. (K3, S5, S9) Explains how they integrate electrical and electronic engineering into their designs. (K8, S5, S9) Explains how they apply their design mechanical systems to operate in a time and/or cost-efficient manner. (S5) Describes the different manufacturing methods and hand fitting techniques they use in building components and assemblies. (S11) Describes how they take into account health and safety considerations for themselves and others while modelling health | Describes how they critically analyse their approach and design to learn lessons and improve their way of working. (S5, S9) Explains how they produce designs that exceed expectations in terms of performance, cost or efficiency. (S5, S9) |

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| | <p>and safety conscious behaviour. (B1)</p> <p>Explains how they adjust their approach taking account of different conditions, technologies (including new and emerging ones), situations and environments. (B6)</p> | |
| <p>Communication: S1, B7</p> | <p>Describes how they pitch technical reports appropriately. Describes how they use digital tools to communicate more effectively. (S1)</p> <p>Explains how they work ethically and in a transparent way, sharing information openly, demonstrating fairness to all. (B7)</p> | <p>Describes how they use a range of communication methods pitching that communication appropriately to the audience. Justifies their choices. (S1)</p> |
| <p>Professionalism: B2, B9, B10</p> | <p>Explains how they work independently, taking responsibility for their actions and making their own decisions. And how they set themselves challenging personal targets. (B2)</p> <p>Explains how they have actively participated in continuous personal development and learning. (B9)</p> <p>Explains how they have demonstrated their commitment to professional standards or codes of conduct. (B10)</p> | <p>Evaluates the impact of not keeping up to date with personal development and learning and the potential consequences and risks to the operations of the business of not doing so. (B9)</p> <p>Describes how they lead discussions on professional standards, influence others to maintain those standards. Describes the impact that has on individuals, the business and the industry. (B10)</p> |