Degree apprenticeship standard for Science industry process and plant engineer Level 6

End-point assessment plan

Foreword

This end-point assessment plan is for the Science industry process and plant engineer degree apprenticeship standard, level 6. It has been designed by industry experts, who have many years of experience working in the sector - who form the Life Sciences & Industrial Science (LS&IS) Trailblazer group and the subject of extensive consultation. The LS&IS Trailblazer group includes employers from chemical manufacture, pharmaceutical, biotechnology, downstream oil, and engineering contractors. Whatever the nature of the organisation, the competence of its people is critical to achieving its business aims. This is why our apprenticeships must produce people who are able to work to the industry standard and contribute to their business from day one. This end-point assessment plan will ensure that successful science industry process and plant engineer degree apprentices have demonstrated that they have the knowledge, understanding, skills and behaviours needed to work in this exciting industry.

Introduction

This plan describes the mandatory end-point assessment (EPA) for the **Science industry process and plant engineer degree apprenticeship standard, level 6.**

The document will be of interest to training providers, end-point assessment organisations (EPAOs), apprentices and employers who need to understand how an apprentice who has been trained for this occupation must be assessed at the end of their apprenticeship.

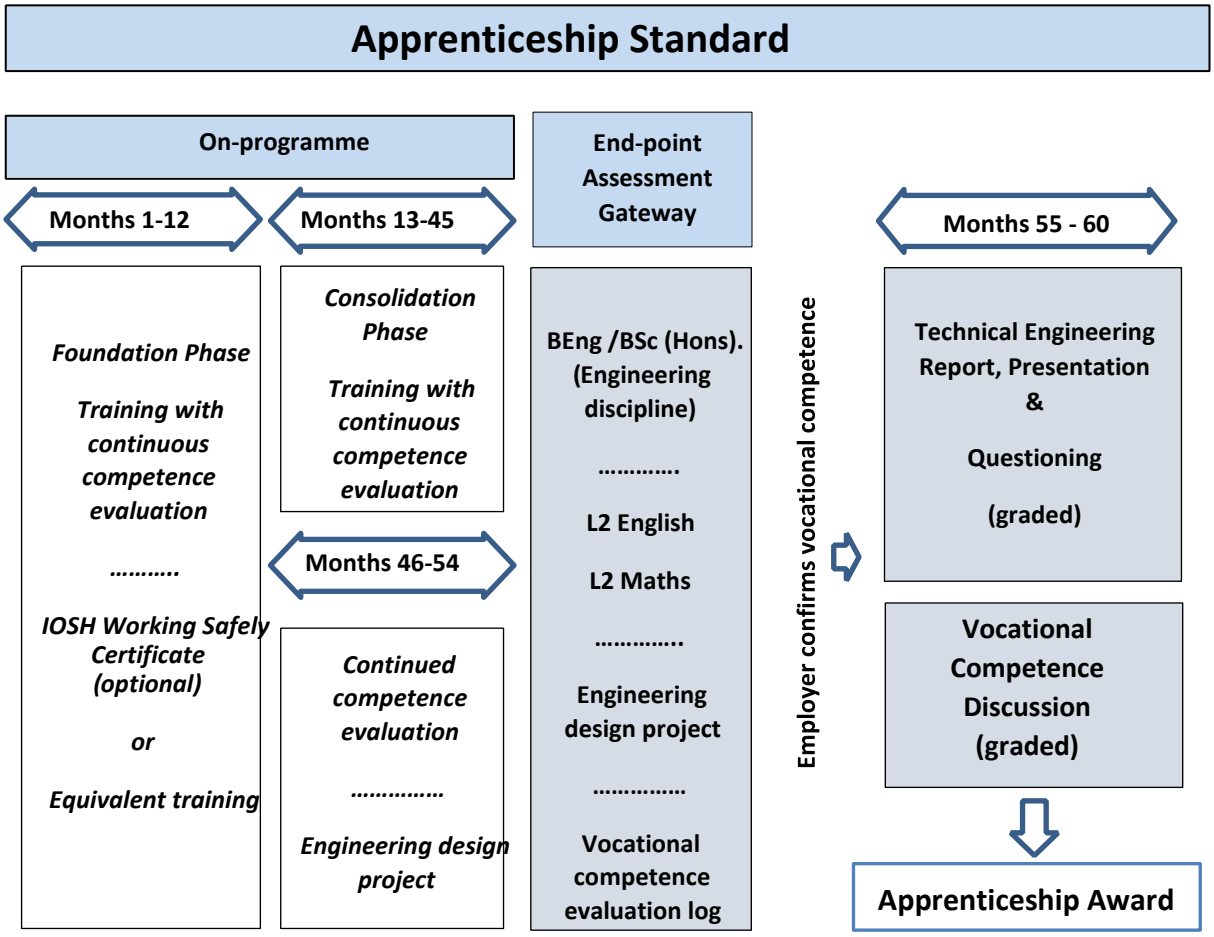
This document does not cover the on-programme training/assessment and on-going competence evaluation carried out by employers or their nominated training providers, which is not part of the mandatory end-point assessment.

Notes for clarification:

- *The term competence evaluation is used to describe activities associated with the on-programme review of an apprentice's competence by an employer or their nominated training provider.*
- *The term employer is used to refer to the host employer or direct employer, which is the company where the apprentice gains their competency experience. It does not refer to an organisation such as an Apprenticeship Training Association (ATA) that has the employment contract with the apprentice.*
- *The term technical expert is used to describe an individual nominated by the employer to support the end-point assessment; EPAOs must confirm they meet the requirements for technical expert, as set out in this plan*
- *The term independent assessor is used to describe an individual working for an EPAO that meets the independent assessor requirements, as set out in this plan.*

Summary of the Science industry process and plant engineer degree apprenticeship

Diagram - Typical apprentice journey



A Science industry process and plant engineer degree apprenticeship will typically require 54 months on-programme training/assessment to meet the requirements of the standard.

Achievement of a BEng (Honours)/ BSc (Honours) degree is a gateway requirement for starting the EPA, along with English and maths at level 2 - achieved either before or during the apprenticeship, the completion of an engineering design project and a vocational competence evaluation (VCD) log (log). The employer must confirm that the apprentice has completed the gateway requirements and is ready for the EPA.

The EPA must be conducted by an EPAO on the Register of End-point Assessment Organisations (RoEPAOs), which is approved to deliver EPA for this apprenticeship standard.

The EPA consists of 2 assessment methods:

- technical engineering report, presentation & questioning
- vocational competence discussion

The assessment methods must be completed within a maximum 6-month period, after the EPA gateway.

Performance in the EPA will determine the apprenticeship grade – fail, pass or distinction. The apprentice must pass both EPA methods to successfully complete the apprenticeship.

Successful apprentices may be eligible to apply for Incorporated Engineer (IEng), through a relevant licensed (by Engineering Council) Professional Engineering Institution (PEI) e.g. IChemE, IMechE. This apprenticeship is aligned to Engineering Council UK-SPEC at Incorporated Engineer (IEng) standard.

Science industry process and plant engineer work-based learning guide

The LS&IS Trailblazer employers have developed a Science industry process and plant engineer work based learning guide. It provides a detailed specification of the knowledge, skills and behaviours (KSBs) required to achieve occupational competence. It is recommended that an apprenticeship on programme training plan is mapped to the work based learning guide. It is freely available at www.siasuk.com

End-point Assessment Gateway

Apprentices must complete the gateway requirements detailed below before taking the EPA.

Science based Engineering Bachelor's Degree

Apprentices must complete a Bachelor's Degree in an engineering discipline; Chemical, Biochemical, Biomedical, Mechanical, Manufacturing, Process.

Example degrees include:

- BEng (Honours) Chemical Engineering
- BEng (Honours) Mechanical Engineering
- BEng (Honours) Process Engineering
- BEng(Honours) Biochemical Engineering
- BSc (Honours) Mechanical Engineering
- BSc (Honours) Chemical Engineering

The range of BEng (Honours) or BSc (Honours) degree qualifications that may be used allows employers/apprentices the flexibility to tailor the apprenticeship to meet their needs, whilst meeting the minimum requirements of the apprenticeship standard.

Engineering design project

The aim of the engineering design project is to allow the apprentice to apply their engineering knowledge to an open ended problem. The project will provide the basis for the technical engineering report, presentation and questioning component of the EPA – all elements must be completed after the EPA gateway.

The engineering design project must allow the apprentice to critically identify, define, conceptualise and analyse complex/professional problems and issues. This will be a substantial piece of work showing the ability to apply a wide range of their principal professional skills, technical knowledge, design techniques and practices in the context of a real process and or plant engineering problem.

The project will focus on the technical engineering content; demonstrating personal involvement in the work; providing explanation of content and findings; and showing the analysis and evaluation of information and supporting data and references to any published academic papers. Typical project examples include:-

- Design data and feasibility of constructing a new process or processing step
- A novel engineering solution to a process improvement or upgrade
- Design and installation of a new or upgrade utility or service

The project must cover the chemical, process and/or plant engineering issues, showing integration with other engineering and technical management disciplines to produce an appropriate total design or solution(s) for safe and useful application. The project must also critical analysis of any

appropriate engineering information, publications and own data and the development of investigative and work orientated skills. The scope of the project must cover, but need not be limited to:

1. Project scope, planning & resources
    a. Definition of the scientific business context to the design project including perceived advantages & limitations
    b. Clear project plan and predicted timescales
    c. Consideration of resources and regulations with particular attention to relevant process safety requirements, product quality and assessment of risk

2. Problem definition and data analysis
    a. Understanding of process/plant engineering drawings relevant to the problem statement
    b. Description of equipment and/or facilities involved, constraints and risks
    c. Analysis of scientific information, engineering data and design calculations pertinent to project

3. Design solution, implementation or simulation
    a. Presentation of design solution including updated engineering drawings/calculations and use of appropriate engineering informatics packages
    b. Documented implementation or simulation of proposed design solution including real/simulated data
    c. Predicted or actual processing equipment and plant performance

4. Business impact, results and conclusions
    a. Reporting of the results of the design implementation
    b. Business implications of the design solution including basic understanding of financial implications and an economic impact analysis
    c. Conclusions drawn including personal reflection on the project scope and definition

The engineering design project should be undertaken towards the end of the on-programme phase, once the majority of learning is complete. It must be of sufficient depth and complexity to require a minimum of 100 hours of work with an additional 50 hours for project reporting. However, the apprentice should not limit the scope of their project to meet this requirement. Because of the significance of the project, the employer and Higher Education Institution may work together with the apprentice to agree a project that is achievable within the employer's business constraints, meets the employer's expectations and has a level of HE challenge appropriate to a BEng (Hons) or BSc (Hons). The design project should be conducted as part of an apprentice's normal engineering work. The apprentice may choose to use their design project completed as partial fulfilment of the

BEng (Hons) or BSc (Hons). Collaboration between the employer and the HEI is encouraged, with mentoring support for the apprentice from both the employer and the HEI. The employer must confirm the project is the apprentice's own work.

Vocational competence evaluation log (log)

A summary record of on-programme vocational competence evaluation, signed off by a technical expert nominated by the apprentice's employer, must be recorded in a log. This reflects the industry practice of competence management through on-going employer competence evaluation. The signed log may also be used to support professional recognition requirements.

A log must detail what evidence was used to confirm the apprentice demonstrated competence, where it was generated, how it was evaluated and by whom against all KSBs in the apprenticeship standard. There is no need to capture the evidence itself in the log. However, the log must provide a reference to where the evidence is held. Typical evidence may include for example, a course assessment portfolio, a company workbook, performance review record or certificate of training. During the vocational competence discussion, the apprentice must have the opportunity to refer to the log and evidence referenced within it to evidence their answers.

This signed log will be used as the evidence that the employer has confirmed the apprentice has developed all the knowledge, skills and behaviours (KSBs) defined in the apprenticeship standard. This must be provided to the EPAO at gateway in order for EPA to go ahead.

EPAOs must provide guidance on what format the log might take.

English and Maths Level 2

Apprentices must hold a minimum of level 2 English and maths, achieved either before or during the apprenticeship, before completing the EPA.

On completion of the gateway requirements, the employer must confirm the apprentice as ready for the EPA. EPAOs will need to see evidence that the gateway requirements have been met.

The End-point Assessment Roles & Responsibilities

An apprentice's employer must select an EPAO from the Education & Skills Funding Agency (ESFA) Register of End-point Assessment Organisations (RoEPAO), which is approved to deliver EPA for this apprenticeship standard.

EPAOs must appoint independent assessors to conduct EPAs, who must meet the requirements for independent assessors as set out in this plan.

Employers must nominate a technical expert to be a member of the EPA panel and advise the EPAO of their details. The EPAO must confirm that they meet the requirements for technical experts as set out in this plan. Technical experts will generally be employed by the apprentice's employer. In some instances, the employer, for example an SME, may wish to contract a technical expert from outside their company if they do not have the capacity or capability to provide one. They are also responsible for reviewing and signing off the apprentice's log.

EPAOs, in discussion with the apprentice's employer, must draw up an EPA schedule. It must detail: the apprentice's independent assessor, when the technical engineering report must be submitted to the apprentice's independent assessor the date(s) for the technical report presentation & questioning and vocational competence discussion and the members of the EPA panel.

EPAOs must ensure that the assessments are conducted in accordance with this EPA plan.

Independent assessors have responsibility for making assessment decisions for the 2 assessment methods, subject to EPAO moderation.

The technical engineering report presentation & questioning elements will be conducted in the presence of an EPA panel - comprising of 2 members: a technical expert and independent assessor. Independent assessors are responsible for making the assessment decisions, following discussion with the technical expert. The technical expert is present to confirm the authenticity of the apprentice's work, provide guidance to the assessor on workplace policy and provide a realistic environment for a presentation. The technical expert may participate in the questioning, but must not supply any information on behalf of the apprentice or participate in the final assessment decision.

With prior approval of the EPAO, the employer may request that no more than one other person attends the EPA panel, such as a representative from the employer, the university or from a professional body, in this instance the representative may act as an observer but may not participate. External quality assurance personnel may also be present at some EPA panels to observe the process.

The VCD will be conducted on a one-to one basis between the apprentice and the independent assessor. External quality assurance personnel may also be present at some VCDs to observe the process.

End-point Assessment Methods

The EPA consists of 2 assessment methods:

- technical engineering report, presentation & questioning
- vocational competence discussion

EPA methods must be successfully completed during a maximum 6-month period, after the EPA gateway. This process should be planned to accommodate operations, apprentice, technical expert and independent assessor availability. Assessments may be consecutive or phased over this period. The assessment methods can be taken in any order; for cost efficiency it is recommended that they should take place on the same day however, that is not a requirement.

The table in appendix 1 shows the KSBs that will be assessed by each assessment method.

The assessment criteria for the technical engineering report, presentation & discussion and VCD are detailed in appendices 2 and 3 respectively.

Requirements for each assessment method are detailed below.

Technical Engineering Report, Presentation and Questioning

A technical engineering report based on the apprentices engineering design project must be prepared by the apprentice at the start of the EPA period and submitted to their independent assessor by the end of month 2 of the EPA period, prior to a presentation and questioning on the technical engineering report to an EPA panel.

The technical engineering report must:

- show the ability to design a work-based independent investigation based on core engineering principles within environments that maybe highly regulated
- demonstrate innovative/creative-thinking and analytical skills
- cover project design, planning, methods, results, data analysis, evaluation, and use of information technology for example computer aided design and informatics
- include conclusions and recommendations
- provide references to alignment to business and financial considerations, engineering and scientific resources, technical data analysis reports, scientific and published engineering literature
- cover the business environment in which the company operates, including personal role within the organisation

The technical engineering report must contain a maximum 3000 words inclusive of main text, figures, tables and boxes and technical drawings but not including references.

The independent assessor must review the technical engineering report before the apprentice presents the technical engineering report to an EPA Panel. The report must meet the above criteria before the presentation and questioning is undertaken.

The presentation should highlight:

- the defined engineering problem and data analysis within the business and regulatory context, including any relevant reference materials
- the complexity, challenge and understanding of the engineering design project and the safe and useful application of the design solution
- design approach taken to implementing a solution including safety, regulatory constraints and data analysis
- business implications and integration with other engineering and technical management disciplines to produce a total design solution (including the economics of the work, operating and investment cost)
- personal reflection and learning following project completion, including the demonstration of teamwork and leadership in the development of the project and report

The apprentice may choose to use presentation aides, such as PowerPoint, multimedia and video.

The independent assessor must ask the apprentice 6 open questions relating to the technical engineering report; follow up questions are allowed for clarification. EPAOs must develop a bank of questions, with a minimum of 50 potential questions, which must be refreshed as a minimum on an annual basis.

The question topics must cover:

- project scope, planning & resources
- problem definition, results, data analysis, challenging assumptions, drawing conclusions.
- design solutions, recommendations and implementations including design specifications of process, plant and/or equipment for new or modifications to a system
- business impact, conclusions and stakeholder management
- use of personal/professional skills

The presentation must last 25-30 minutes and the questioning 50-60 minutes. The presentation and questioning may be conducted via video-conferencing.

EPA Panel Rules

The independent assessor must:

a. Plan the EPA panel prior to it taking place.

b. Ensure that the location for the panel is appropriate; it may be conducted via videoconferencing. The presentation and discussion must take place in a room free from distractions, with no other people present except those with prior approval from the EPAO or from the external quality assurance body.

c. Ensure the technical expert has been approved by the EPAO, as meeting the requirements for technical expert.

d. Ensure they and the technical expert has received the technical engineering report 2 weeks before the panel takes place.

e. Ensure the technical expert is fully briefed about the process and their role before the EPA panel commences.

f. Ensure any special needs of the apprentice are taken into consideration.

g. Chair the EPA panel.

i. Ensure that the apprentice understands the EPA panel process, the possible outcomes and how it is graded.

j. Do their best to ensure that the apprentice is at ease.

k. Ensure that the grading criteria and relevant documentation are to hand before commencing.

l. Ensure they use the specified assessment grading criteria.

m. Be documented or recorded electronically with the agreement of the employer and the apprentice
n. Ensure the apprentice is not informed of the outcome of the assessment at this stage.
o. Seek guidance from the technical expert as required.
p. Agree with the panel members that the presentation and questioning rules have been followed.
q. Make the decision about the outcome of the assessments (pass/fail) and recommend the grade.
r. Send documentation to the EPAO within the agreed timescale.

Vocational Competence Discussion

Apprentices must take part in a vocational competence discussion with an independent assessor, on a one-to-one basis.

Independent assessors must ask 6 open competence based questions, one relating to each of the categories below; follow up questions are allowed for clarification:

- application of process, plant and product and quality management processes
- legislative and regulatory engineering, process, safety and environment control
- good practice in using appropriate engineering and company procedures in a scientific manufacturing environment
- commissioning process of capital, maintenance, revenue projects, setting and meeting targets
- the introduction of new scientific and process/plant engineering technologies and practices
- continuous improvement and change management processes

The apprentice must answer each question with examples from their own practice. The apprentice must bring their log to the VCD and may refer to it and evidence referenced in it to support their answers.

Examples of these questions as follows:

- Describe what constitutes the quality management system in which your organisation operates and the role you play within that?
- Explain your understanding of continuous improvement within the Science Industry and illustrate using a relevant example, describing your role and tools used?
- Describe what 'good practice' is applicable to your organisation and how this impacts your role?
- What steps would you need to take on introduction of a new technology or novel process, what are the key considerations within the regulated environment?

EPAOs must develop a bank of open competency based questions covering the 6 categories, with a minimum of 50 potential questions, which must be refreshed as a minimum on an annual basis.

The VCD must:

a. be in the format of a 1:1 discussion with the independent assessor; this may be via videoconferencing
b. comprise 6 questions from the 6 categories listed above
c. must last 1hour 45minutes and maximum 2 hours
d. take place in a room, free from distractions with no other people present, except quality assurance personnel where required
e. be documented or recorded electronically with the agreement of the employer and the apprentice

The independent assessor must:

a. Select the VCD questions from the EPAO's question bank prior to it taking place.
b. Ensure that the location for the VCD is appropriate.
c. Ensure any special needs and safeguarding of the apprentice is taken into consideration.
d. Ensure that the apprentice understands the VCD process, the possible outcomes and how it is graded.
e. Do their best to ensure that the apprentice is at ease.
f. Ensure that he/she has the assessment criteria and relevant documentation to hand before commencing the VCD.
g. Complete the relevant documentation, including notes of what is discussed, and send it to the EPAO within the agreed timescale.
h. Ensure that the EPAO is notified of the outcome of the VCD within the agreed timescale.

Grading

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

The independent assessor must combine the results from each assessment method to determine the EPA/apprenticeship grade. Grades will not be confirmed until after moderation.

The assessment methods are equally weighted. A fail will be awarded where the apprentice fails one or both assessment methods. A pass will be awarded to individuals that achieve a pass or distinction in both assessment methods. A distinction will be awarded to individuals that achieve a distinction in both assessment methods.

Re-takes/re-sits

Apprentices who fail an assessment method(s) will be offered the opportunity to take a re-sit/re-take. A resit does not require any further learning, whereas a re-take does. The employer will need to agree that a re-sit/re-take is an appropriate course of action. Any assessment method re-sit/re-take must be taken during the maximum 6-month EPA period; otherwise the entire EPA must be retaken. They are not offered to apprentices wishing to move from pass to distinction. Re-sits/re-takes will not be awarded a grade higher than pass, unless the EPAO determines there were exceptional circumstances accounting for the fail. Apprentices should have a supportive action plan to prepare for the re-sit/re-take.

Professional Body Recognition

The LS&IS Trailblazer employers have worked in partnership with professional bodies to define the apprenticeship standard and the EPA plan to ensure that it aligns to the Engineering Council UKSPEC at Incorporated Engineer (IEng) standard. The scope of the standard and the associated EPA plan means that the individual should not require any further training on completion of their apprenticeship to allow them to apply for professional registration as Incorporated Engineer (IEng) through a relevant licensed (by Engineering Council) Professional Engineering Institution (PEI) e.g. IChemE, IMechE.

End-point Assessment Organisations

Organisations delivering EPA must be on the Education & Skills Funding Agency register of apprentice EPAOs approved to deliver EPA for this apprenticeship standard. EPAOs must be able to demonstrate the occupational and assessment capacity and capability.

Assessment Instrument Criteria

EPAOs should develop their assessment instruments and supporting materials to reflect the apprenticeship standard and the assessment specifications. It is recommended that the work based learning guide is also used as a reference. An EPAO must produce the full suite of assessment instruments. The EPAO must produce full guidance on the use of each assessment instrument with details of performance standards and assessment criteria.

Technical Expert and Independent Assessor Criteria

Technical Expert Criteria

EPAOs must confirm technical experts meet the following criteria.

Technical Expert Criteria

✓ Vocationally competent with recent continuing professional development
and/or
Professionally registered

Plus

✓ experience of current working practices

Plus

✓ EPAO induction

Technical experts must be competent in the occupation. This must be shown through the individual having at least 5-years recent work experience in the occupational area or by having achieved a qualification at a level higher than the level of the apprenticeship standard being assessed; or by holding professional recognition at a level equivalent to or higher than the registration level of the apprenticeship standard being assessed.

Technical experts must be either working in the science industry itself or they must be able to demonstrate they possess practical and up-to-date knowledge and experience of current working practices appropriate to the science industry, able to provide evidence of 5 days CPD in the last year. There may be a requirement to hold additional specialist training or security clearance as required by the industry sector e.g. nuclear.

Technical experts must complete an EPAO induction to demonstrate working knowledge of the apprenticeship standard and assessment methodology.

Independent Assessor criteria

EPAOs must confirm that independent assessors meet the following criteria.

Independent Assessor Criteria

✓ Independent of the apprentice, their training provider and employer

✓ Any current UK qualifications for workplace vocational assessors
or
Workplace Competence Assessor Award

Plus

✓ Vocationally competent with recent continuing professional development
and/or
Professionally registered
Plus

✓ EPAO induction

The EPA must be delivered in such a way that no party who has been involved in delivery can make the sole decision on competence. The approach must clearly deliver an impartial result. For this reason, independent assessors appointed by EPAOs must not be linked to the apprentice, or their training provider or employer.

Independent assessors must hold a current UK qualification for workplace vocational assessors or a Workplace Competence Assessor Award.

Independent assessors must be competent in the occupational area they are assessing. This must be shown through the individual having achieved a qualification at a level higher than the level of the apprenticeship standard being assessed; or by holding professional recognition at a level equivalent to or higher than the registration level of the apprenticeship standard being assessed.

Individuals must be able to demonstrate they possess practical and up-to-date knowledge of current working practices, engineering, process safety or product quality regulations such as The Medicines and Healthcare Products Regulatory Agency (MHRA) or HSE the Control of Major Accident Hazards (COMAH) regulations appropriate to the sector in which they are carrying out assessment practice.

Independent assessors must:

- Maintain a continuous, up-to-date and accurate record of their CPD activities this should equate to at least 5 days CPD in the last year
- Demonstrate that their CPD activities are of learning activities relevant to current or future practice
- Seek to ensure that their CPD has benefited the quality of their practice
- Seek to ensure that their CPD has benefited the users of their work

- Present a written profile containing evidence of their CPD on request

There may be a requirement to hold additional specialist training or security clearance as required by the industry sector e.g. nuclear.

Individuals must complete an EPAO induction to demonstrate working knowledge of the apprenticeship standard and assessment methodology.

Internal Quality Assurance

EPAOs must have internal quality assurance arrangements that meet the following minimum requirements.

They must moderate Independent assessors' EPA decisions. The EPA grade must not be confirmed until after moderation. As a minimum, 20% of all independent assessors' EPA decisions must be moderated, sampled across different apprentices and employers. Moderation must be higher for in-experienced independent assessors, where moderation has identified inconsistent grading decisions or grading decisions have been disputed.

They must run induction training for technical experts and independent assessors covering the apprenticeship standard and assessment methodology. Other training should be provided to meet individual's identified training needs.

Annual standardisation events must be held for independent assessors to ensure consistency in the assessment practice and decisions.

EPAOs must ensure independent assessors and technical experts meet the qualification and experience requirements detailed above.

External Quality Assurance

External quality assurance for this apprenticeship standard will be managed by the Institute for Apprenticeships.

Implementation

The EPA has been designed to provide a cost effective assessment approach that meets quality objectives – the use of video conferencing may reduce cost and ensure EPA is available to learners regardless of location. For this standard there are likely to be small cohorts of apprentices spread nationally, so the assessment model needs to be flexible for delivery in a number of varied settings and contexts. It is anticipated that there will be 15 apprenticeship starts in the first year, rising to 100 annually. The on-programme qualifications that are required to be completed are already available.

It is anticipated that the EPA will cost 20% of the maximum funding band for this apprenticeship, based on costings provided.

Appendix 1 - Assessment Method by Element of the Standard – Science industry process and plant engineer degree apprenticeship

KEY:	
Technical Engineering Report, Presentation & Questioning	**TER/PQ**
Vocational Competence Discussion	**VCD**

	Knowledge	**EPA**
1	Core engineering principles including mathematics and science and their application to relevant area of specialism	**TER/PQ**
2	The product manufacturing process within the science industry	**TER/PQ**
3	Principles of computer aided design; computer aided engineering and appropriate engineering informatics packages	**TER/PQ**
4	Engineering project management procedures and how to incorporate these into the engineering/scientific work environment.	**TER/PQ**
5	The internal and external regulatory environment pertinent to the science sector.	**TER/PQ**
6	Industrial finance: capital and operating expenditure, particularly when applied to feasibility studies and comparison of competing tenders	**VCD**
7	The business environment in which the company operates including personal role within the organisation, ethical practice and codes of conduct.	**TER/PQ**
8	The principles of process and product safety and sustainability relevant to the sector.	**VCD**
9	The principles of quality management processes relevant to the sector e.g. Good Manufacturing Practice (GMP), Quality Control (QC), Quality Assurance (QA).	**VCD**
	Skills	
10	Ensure the control, within own area of responsibility, of major accident hazards, health & safety, to statutory, mandatory and environmental standards.	**VCD**

11	Ensure that targets are met and maintained, within own area of responsibility, whilst complying with defined company procedures and legislative requirements.	**VCD**
12	Prepare for and perform process/plant engineering tasks using the appropriate techniques, procedures and methods.	**VCD**
13	Support the evaluation, submission, planning, installation and commissioning of capital, maintenance and revenue projects to improve process performance.	**VCD**
14	Work autonomously to analyse, interpret and evaluate engineering data, presenting the results and problem solving approach clearly and concisely in written and oral form, using technology where appropriate to assist with and evaluate activities.	**TER/PQ**
15	Apply continuous improvement techniques and support existing manufacturing principles to drive effectiveness and efficiency.	**VCD**
16	Manage and/or support the introduction of new technologies and practices.	**VCD**
17	Use creative thinking and problem solving to challenge assumptions, innovate, make new proposals and build on existing ideas	**TER/PQ**
18	Plan and prioritise process/plant tasks using project planning tools, review and evaluate progress against objectives and investigate alternative scenarios.	**TER/PQ**
	Behaviours	
19	Have a safety and quality approach that ensures strict compliance and a disciplined, responsible attitude to mitigate and manage risk.	**VCD**
20	Communicate appropriately to a scientific and non-scientific audience.	**TER/PQ**
21	Is reliable and shows integrity and respect for confidentiality on work related and personal matters, including appropriate use of social media and information systems.	**VCD**
22	Work autonomously and interact effectively within a wide, multi-disciplinary team, understanding the impact of work on others, especially where related to workplace ethics, diversity and equality.	**TER/PQ**
23	Applies a logical thought process, being able to incorporate the ideas of others and quickly process information.	**TER/PQ**
24	Handle and respond to change, adjusting to different conditions, technologies, situations and environments.	**VCD**

25	Take responsibility for continuing personal and professional development, demonstrating commitment to learning and self-improvement and support the development of others as appropriate.	**TER/PQ**

Appendix 2 – Technical Engineering Report, Presentation and Questioning assessment criteria

Ref:	Area of standard	Fail	Pass	Distinction
K1 K2 K5	Engineering & regulatory reference materials and published information	Engineering & regulatory reference materials review lacks evidence and structure, uses outdated results or inappropriate engineering data	A systematic analysis of relevant engineering & regulatory information within a justified validity period	A critical analysis of relevant engineering & regulatory information across the science/engineering field evaluating the evidence in relevance to the design project
K2 K4 S18	Project scope, planning & resources	Lack of clarity on project scope and boundary definition ill defined, little demonstration of effective planning and resource allocation	Project scope and boundaries clearly defined to the engineering business context of the design project. Providing clear project plan and predicted timescales showing consideration of resources	Demonstrates high level of understanding of customer requirements. The project scope and boundaries are defined to allow predicted and unforeseen benefits of the design solution to be realised
K3 S14	Data analysis, use of information technology	Misinterprets data and uses inappropriate statistical tools to analyse data	Well-structured data analysis using at least one appropriate statistical tool or analytical technique to test engineering information, data and design using calculations pertinent to project such as probability distributions, significance testing & confidence limits, regression & correlation	Systematic data analysis using at least one appropriate advanced statistical tool or technique such as t-test, chi-square test, multivariate analysis, predictive models

K7 K6 S14 S17	Drawing conclusions, impacts on business and cost implications	Inapposite conclusions based on misinterpretation of engineering data, published reference materials and data and lack of consideration of business and cost implications	Reasoned conclusions based on appropriate engineering data analysis and consideration of business and cost implications	Clearly defined Engineering conclusions leading to logical recommendations for future projects. Conclusions drawn including personal reflection on the project scope and definition and future longer term business, cost benefits
S17 B20	Stakeholder management	Project communication is vague or poor, difficulty conveying meaning to others	Tools used to define project stakeholders internal & external to the project	Clear management of all stakeholders expectations and use of engineering judgement to influence project direction
K1 K2 S17	Project design within the science industry	Limited understanding of project design	Robust understanding of project design used to develop and justify engineering design approach	Advanced engineering analysis techniques used to define engineering design approach and project results
B22 B25	Project Recommendations	Unable to explain recommendations based on conclusions	Recommendations for immediate next steps justified with reference to conclusions	Logical recommendations for future projects linked to engineering design conclusions
B20	Presentation	Unable to effectively present technical project elements and personal viewpoints	Confident, articulate presentation. Able to respond to technical questioning with ability to respect opinion of others	Proactively seeks feedback to improve analysis and personal performance
S17 B23	Use of personal/professional skills	Overall approach to project does not demonstrate use of personal/professional skills and good	Overall approach to project demonstrates use of personal/professional skills and good	Builds working relationships between team and other groups. Demonstrates creative thinking to resolve obstacles and

		working practices within the context of the work-based project activity	working practices within the context of the work-based project activity	recommends improvements based on personal experience
B22	Teamwork & leadership	Unable to provide examples of challenging assumptions within a wide, multi-disciplinary project team and promoting change within the workplace	Provides examples of working autonomously and interacting effectively taking account of the impact of the work on others	Provides examples of leading change and challenging practice to improve own work and work of others
B25	Personal reflection and learning	Unable to demonstrate sufficient teamwork and leadership in the development of the project and report	Provides demonstration of good teamwork and leadership in the development of the project and report, demonstrates opportunities to learning and self-improvement	Provides examples of leading team to achieve project objectives demonstrating commitment to learning and self-improvement and support the development of others

A fail will be awarded where the apprentice demonstrates one or more of the fail criteria for the Technical Engineering Report, Presentation and Questioning KSBs.

A pass will be awarded where the apprentice achieves all the pass criteria for the Technical Engineering Report, Presentation and Questioning KSBs.

A distinction will be awarded where the apprentice achieves all the pass and distinction criterial for the Technical Engineering Report, Presentation and Questioning KSBs.

Appendix 3 - VCD Assessment Criteria

Ref:	Area of standard	Fails	Pass	Distinction
K9 B19	**Application of process, plant and product and quality management processes**	Cannot explain the application of process, plant, product and quality management policies and procedures.	Explain the application of process, plant, product and quality management policies and procedures. Supports explanation with example from own practice	Explain how the application of process, plant, product and quality management policies and procedures by themselves and others impacts on the wider business. Supports explanation with example of impact on the business
K8 S10 S11 B19	**Legislative and regulatory engineering, process, safety and environment control**	Cannot explain impact of legislative and regulatory engineering, process, safety and environment control on own role	Explain legislative and regulatory engineering, process, safety and environment control Supports explanation with example from own practice	Explain how compliance with legislative and regulatory engineering, process, safety and environment control impacts on the wider business Supports explanation with example of impact on the business
S12 B21	**Good practice in using appropriate engineering and company procedures in a scientific manufacturing environment**	Cannot explain good practice in using appropriate engineering and company procedures in a scientific manufacturing environment	Explain good practice in using appropriate engineering and company procedures in a scientific manufacturing environment Supports explanation with example from own practice	Explain how good practice in using appropriate engineering and company procedures in a scientific manufacturing environment impacts on the wider business Supports explanation with example of impact on the business

K6 S13	**Commissioning process of capital, maintenance, revenue projects, setting and meeting targets**	Cannot explain commissioning process of capital, maintenance, revenue projects, setting and meeting targets	Explain commissioning process of capital, maintenance, revenue projects, setting and meeting targets Supports explanation with example from own practice	Explain how commissioning process of capital, maintenance, revenue projects, setting and meeting targets impacts on the wider business Supports explanation with example of impact on the business
S16	**The introduction of new scientific and process/plant engineering technologies and practices**	Cannot explain the introduction of new scientific and process/plant engineering technologies and practices	Explain the introduction of new scientific and process/plant engineering technologies and practices Supports explanation with example from own practice	Explain how the introduction of new scientific and process/plant engineering technologies and practices impacts on the wider business Supports explanation with example of impact on the business
B24 S15	**Continuous improvement and change management processes**	Cannot explain continuous improvement and change management processes	Explain continuous improvement and change management processes Supports explanation with example from own practice	Explain how continuous improvement and change management processes impacts on the wider business Supports explanation with example of impact on the business

VCD Grading

Fail = demonstrates one or more of the fail criteria in any of the discussion areas

Pass = achieves pass criteria in all of the discussion areas

Distinction = achieves pass and distinction criteria in all discussion areas