

Highfield Level 4 End-Point Assessment for High Speed Rail and Infrastructure Advanced Technician - Power Pathway

End-Point Assessment Kit



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EPA Kit

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How to use this EPA kit

Welcome to the Highfield end-point assessment kit for the Level 4 High Speed Rail and Infrastructure Advanced Technician (Power) Apprenticeship Standard.

Highfield is an independent end-point assessment organisation that has been approved to offer and carry out the independent end-point assessments for the Level 4 High Speed Rail and Infrastructure Advanced Technician Apprenticeship Standard. Highfield internally quality assures all end-point assessments in accordance with its IQA process. Additionally, all end-point assessments are externally quality assured by the relevant EQA organisation.

The EPA kit is designed to outline all you need to know about the end-point assessments for this standard and will also provide an overview of the on-programme delivery requirements. In addition, advice and guidance for trainers on how to prepare apprentices for the end-point assessment is included. The approaches suggested are not the only ways in which an apprentice may be prepared for their assessments, but trainers may find them helpful as a starting point.

Key facts

Apprenticeship standard:	High Speed Rail and Infrastructure Advanced Technician (Power Pathway)
Level:	4
On-programme duration:	Typically 36 months
End-point assessment window:	Maximum of 3 months
Grading:	Pass/merit/distinction
End-point assessment methods:	Knowledge test, practical observation and professional discussion

In this kit, you will find:

- an overview of the standard and any on-programme requirements
- a section focused on delivery, where the standard and assessment criteria are presented in a suggested format that is suitable for delivery
- guidance on how to prepare the apprentice for gateway
- detailed information on which part of the standard is assessed by which assessment method
- suggestions on how to prepare the apprentice for each part of the end-point assessment
- a section focused on the end-point assessment method where the assessment criteria are presented in a format suitable for carrying out 'mock' assessments

Introduction

Standard overview

This Level 4 High Speed Rail and Infrastructure Advanced Technician Apprenticeship has been designed by industry for apprentices employed in a wide variety of different rail organisations that are engaged in the planning, construction and operation of high speed rail projects. The standard aims to address a skills shortage identified during the initial construction and operation of this major infrastructure development in the UK.

On-programme requirements

Although learning, development and on-programme assessment is flexible and the process is not prescribed, the following is the recommended baseline expectation for an apprentice to achieve full competence in line with the high speed rail and infrastructure advanced technician standard.

The maintenance of an on-programme record is important to support the apprentice, on-programme assessor and employer in monitoring the progress of learning and development and to determine when the apprentice has achieved full competence in their job role and is ready for end-point assessment. The on-programme assessment log is **not** a portfolio of evidence, but a record of what the apprentice can do following periods of training, development and assessment. A minimum of one meeting every 2 months is recommended to show ongoing competence across the entire standard. Once the apprentice is deemed competent, the relevant section(s) of the standard should be signed off by the on-programme assessor and employer.

During the last 6 months, the apprentice will complete a 4,000-word work project based on their specialism to support their progress through gateway and to support their professional discussion.

There are no mandatory qualifications for this standard, however, employers may wish to include relevant qualifications to help structure the on-programme delivery.

Readiness for end-point assessment

For an apprentice to be ready for the end-point assessments:

- they must have successfully achieved Level 2 English and maths.
- the employer must be confident that the apprentice has developed all the knowledge, skills and behaviours defined in the apprenticeship standard. To ensure this, the apprentice must attend a formal gateway meeting with their employer to complete the gateway readiness report. This meeting should be attended by the apprentice and relevant people that have worked with the apprentice on-programme, such as the line manager, on-programme trainer/training provider and/or a senior manager (as appropriate to the business).
- the apprentice will bring their completed on-programme work project for the employer to review and use as a basis for deciding whether the apprentice is ready for the end-point assessment. This project is completed on-programme and is related to the apprentice's specialist option. The project, which will have a word limit of 4,000 words, will include appropriate work-related material such as reports, schematics, images, photographs and feedback.
- The apprentice, employer or training provider should complete the Scenario Allocation Form information and submit this to Highfield at Gateway.
- the apprentice and the employer should then engage with Highfield to agree a plan and schedule for each assessment activity to ensure all components are completed within a 3-month end-assessment window. Further information about the gateway process is covered later in this kit.

Order of end-point assessments

The order of end-point assessment will be as follows: the knowledge test, the practical observation and finally, the professional discussion.

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The Highfield approach

This section describes the approach Highfield has adopted in the development of this end-point assessment in terms of its interpretation of the requirements of the end-point assessment plan and other relevant documents.

Documents used in developing this end-point assessment

Standard (2017)

<https://www.instituteforapprenticeships.org/apprenticeship-standards/high-speed-rail-and-infrastructure-technician/>

End-point assessment plan (2017 ST0528/AP01)

<https://www.instituteforapprenticeships.org/media/1460/high-speed-rail-assessment-plan.pdf>

Practical observation

Where it is identified that simulation is the most appropriate means of assessment, this will be planned in advance. Simulation may be required to ensure the apprentice is not disadvantaged when naturally occurring evidence cannot be gathered during the observation time. Simulation may also be required where access to an apprentice's workplace may not be permissible due to any regulatory, health and safety or compliance issues. In this context, simulation is intended to be either:

- the use of technology such as virtual or augmented reality to allow the apprentice to demonstrate competence in required tasks such as rolling stock repair and maintenance, track repair and maintenance or in safety critical situations
- working with real industry equipment to address simulated issues, for example, fault finding using real bogies, where the fault is simulated

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Gateway

How to prepare for gateway

After apprentices have completed their on-programme learning, they should be ready to pass through 'gateway' to their end-point assessment.

Gateway is a meeting that should be arranged between the apprentice, their employer and training provider to determine that the apprentice is ready to undertake their end-point assessment. The apprentice should prepare for this meeting by bringing along work-based evidence, including:

- 4000-word on-programme work project
- reports
- schematics
- photographs/images

As well as evidence from others, such as:

- mid and end-of-year performance reviews
- feedback to show how they have met the apprenticeship standards while on-programme

In advance of gateway, apprentices will need to have:

- achieved level 2 English
- achieved level 2 maths
- completed the Written Submission Form to accompany their work project
- completed the Scenario Allocation Form

Therefore, apprentices should be advised by employers and providers to gather this evidence and undertake these qualifications during their on-programme training. It is recommended that employers and providers complete regular checks and reviews of this evidence to ensure the apprentice is progressing and achieving the standards before the formal gateway meeting is arranged.

The gateway meeting

The gateway meeting should last around an hour and must be completed on or after the apprenticeship on-programme end date. It should be attended by the apprentice and the relevant people who have worked with the apprentice on-programme, such as the line manager/employer or mentor, the on-programme trainer/training provider and/or a senior manager (as appropriate to the business).

During the meeting, the apprentice, employer and training provider will discuss the apprentice's progress to date and confirm if the apprentice has met the full criteria of the apprenticeship standard during their on-programme training. The **Gateway Readiness Report** should be used to log the outcomes of the meeting and agreed by all 3 parties. This report is available to download from the Highfield Assessment website.

The report should then be submitted to Highfield to initiate the end-point assessment process. If you require any support completing the Gateway Readiness Report, please contact your Employer Engagement Manager at Highfield Assessment.

Please note: a copy of the standard should be available to all attendees during the gateway meeting.

Reasonable adjustments and special considerations

Highfield Assessment has measures in place for apprentices who require additional support. Please refer to the Highfield Assessment Reasonable Adjustments Policy for further information/guidance.

ID requirements

Highfield Assessment will need to ensure that the person undertaking an assessment is indeed the person they are claiming to be. All employers are therefore required to ensure that each apprentice has their identification with them on the day of the assessment so the end-point assessor can check.

Highfield Assessment will accept the following as proof of an apprentice's identity:

- a valid passport (any nationality)
- a signed UK photocard driving licence
- a valid warrant card issued by HM forces or the police
- another photographic ID card, e.g. employee ID card, travel card, etc.

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High Speed Rail and Infrastructure Advanced Technician Apprenticeship Standard

The following pages contain the Level 4 High Speed Rail and Infrastructure Advanced Technician Apprenticeship Standard and the assessment criteria in a format that is suitable for delivery.

Core - Health and safety	
Knowledge test	
Pass criteria – the apprentice will know and understand:	
KCHS1	The critical importance of safety and security in the conventional and the high speed railway industries, the principles of safe by design , system assurance , and health and safety legislation
KCHS2	The relationships of health and welfare strategies with safety in the workplace
KCHS3	The relevance of standards , policy , regulation and guidelines for the UK rail industry
KCHS4	Risk assessment and hazard analysis identification, management and mitigation
Amplification	
<p>Safety – the condition of being protected from or unlikely to cause danger, risk, or injury</p> <p>Security – the state of being safe against criminal activity such as terrorism, theft or vandalism</p> <p>Safe by design - the concept of applying methods to minimise occupational hazards early in the design process, with an emphasis on optimising employee health and safety throughout the lifecycle of materials and processes</p> <p>Systems assurance – a process that ensures that a rail infrastructure project functions as intended throughout its entire life cycle</p> <p>Health and safety legislation – Health and Safety at Work etc. Act 1974, Railway and Other Guided Transport Systems (Safety) Regulations (ROGS), Railway Safety Regulations 1997 and 1999, etc.</p> <p>Standards – define functional or technical requirements to be met on UK railways, e.g. those created by the Rail Safety and Standards Board (RSSB), Network Rail etc.</p> <p>Policy – a course or principle of action adopted or proposed by government, organisation or individual, e.g. nationalisation, the Beeching cuts, privatisation, HS2</p>	

Regulation – rules or directives made and maintained by an authority, e.g. Office of Road and Rail (ORR) – Railway (Licensing of Railway Undertaking) Regulations 2005, The Railways and Other Guided Transport Systems (Safety) Regulations (ROGS) etc.

Guidelines – a general rule, principle, or piece of advice, e.g. those issued by the Office of Road and Rail (ORR) on legislation, occupational health etc.

Risk assessment - a systematic documented process of evaluating the potential risks that may be involved in a projected activity or undertaking

Hazard – a source of potential damage, harm or adverse health effects on something or someone

Practical observation	
Pass criteria – the apprentice will be able to:	
SCHS1a	Develop and maintain an effective safety culture
SCHS1b	Embed a culture of health, welfare and safety compliance to ensure the health and safety of employees, customers, visitors and members of the public
SCHS1c	Rigorously apply security procedures
SCHS2a	Apply rigorous health and safety practices ; comply with legislation and safety processes
SCHS3	Comply with relevant standards and regulations
SCHS4	Identify and manage risk, and prepare contingency plans
Amplification	
Compliance - to ensure the health and safety of employees, customers, visitors and members of the public	
Security procedures – refers to the specific procedures to maintain the security of all employees, visitors and members of the public	
Practices – related to health and safety such as use of correct PPE, task-specific safety equipment	
Safety processes – on completion of work/task, work must be signed for traceability and accountability in the event of an accident; following relevant site rules; use of the correct safety equipment and/or software	
Standards and regulations – refer to the various safety processes and practices specific to the employer, those required by the Health and Safety Executive (HSE) and specifically for the railway by the Office of Rail and Road (ORR)	
Contingency plans – plans designed to take account of a possible future event or circumstance	

Professional Discussion
Pass criteria – the apprentice will be able to:
SCHS2b Design safety into all aspects of the rail network, accounting for end-user requirements
Amplification
Design safety – the concept of applying techniques and methods to minimise occupational hazards early in the design phase

Core – Context
Knowledge test
Pass criteria – the apprentice will know and understand:
KCC4 Appropriate fundamental engineering principles
Amplification
<p>Engineering principles – the ideas, rules or concepts that need to be kept in mind when solving an engineering problem, such as:</p> <ul style="list-style-type: none"> ○ Physics theories – Newton’s Laws, Ohm’s Law, Faraday’s Law, Laws of Thermodynamics, Young’s modulus etc. ○ Geometry – the branch of mathematics concerned with the properties and relations of points, lines, surfaces, solids and higher dimensional analogues ○ Trigonometry - the branch of mathematics dealing with the relations of the sides and angles of triangles and with the relevant functions of any angles ○ Electrical and electronic engineering theories – Kirchoff’s Law, circuit theory, capacitance, magnetism, electromagnetism, etc. ○ Metallurgical principles – weight, strength, toughness, hardness, corrosion, fatigue, stress, creep etc.

Practical observation	
Pass criteria – the apprentice will be able to:	
SCC1	Apply effective systems engineering practice, considering the interfaces between work packages and promoting and maintaining effective communications between disciplines
Amplification	
Systems engineering - the interdisciplinary field of engineering and engineering management that focuses on how to design and manage complex systems over their life cycles	
Work packages - a group of related tasks within a project. As they look like projects themselves, they are often thought of as sub-projects with a larger project	
Disciplines - the various branches of engineering, e.g. Civil, Systems, Electrical, Mechanical	
Professional Discussion	
Pass criteria – the apprentice will know and understand:	
KCC1	The context and scope of high speed rail in the UK and internationally, and its integration into the wider transportation system
KCC2	The distinction and interface between conventional and high speed rail
KCC3	The role of specialist areas within conventional and high speed rail; civil engineering, track systems, traction and rolling stock, command, control and communication, power, digital and information operations, business management, systems engineering and integration
Amplification	
Context and scope – transform transport infrastructure in the UK, rebalance the north and south, be an ‘Engine for Growth’, cut carbon emissions, remove traffic from the roads and free-up conventional railways for freight	
Conventional – refers to the existing UK rail network designed to operate over medium to long distances, e.g. regional trains, commuter trains and airport rail links	

Core – Design

Knowledge test

Pass criteria – *the apprentice will know and understand:*

KCD1 The relevance and importance of **sustainability**, environmental, social and economic considerations in the development of a high speed railway

KCD2 How the rail network system is designed, built, installed, operated, maintained, renewed and decommissioned

Amplification

Sustainability – the ability to exist in equilibrium with the eco-system, balancing economic growth and the need for resources with environmental concerns

Professional Discussion

Pass criteria – *the apprentice will know and understand:*

KCD3 The impact of **ergonomics** and **human factors** on the design and operation of the railway

KCD4 The importance of **forward thinking** to future innovation, technology and **ways of working**

Pass criteria – *the apprentice will be able to:*

SCD1 Embed the principles of sustainability and **environmental** considerations into the design, development, installation and operation of high speed rail projects

SCD2 Design and implement innovative solutions using new technologies to improve efficiency, cost, effectiveness, customer service and safety to **work-based problems**

Amplification

Ergonomics - the scientific discipline concerned with the understanding of interactions among humans and other elements of a system

Human factors – the aim of reducing human error, increasing productivity, enhancing safety and comfort with a specific focus on the interaction between the human and the thing of interest

Forward thinking – a mode of progressive thought favouring innovation and development

Ways of working – traditional design methods (2D) versus CAD and the benefits that this can provide

Environmental - can include: agriculture, forestry, soils, air quality, cultural heritage, wildlife and habitat disruption, ecology, landscape and visual amenity, noise and vibration, settlement, traffic and transport, waste and material resources; and water resources

Work-based problems – can be those related to efficiency, cost, effectiveness, customer service and safety etc.

Core – Management

Knowledge test

Pass criteria – *the apprentice will know and understand:*

KCM1 The requirements for, and characteristics of, **leadership, collaboration** and management

KCM2 The principles of effective **project management, stakeholder** management and **quality management**

KCM3 The principles of **asset management**

Amplification

Leadership - different leadership styles (transactional, transformational, charismatic, autocratic, democratic, strategic), vision, values, culture, engagement, motivation, qualities and traits of leaders, inspiring, future-focused, coaching, mentoring and performance management

Collaboration - networking, negotiation, conflict management, consensus, involvement

Project Management - tools and techniques to set up, run and oversee a project – use of project methods such as Prince2, Critical Path analysis, Gantt charts, project plans

Stakeholder - interested parties, affected parties, shareholders, employees, customers, contractors, suppliers, buyers, pressure groups, lobbyists, trades unions, political, governmental, contractual. Board members, senior managers, focus groups, passenger/customer forums. Professional and Industry associations, financial institutions, regulators

Quality management- activities such as procedures, defined criteria, auditing, Total Quality Management (TQM) ISO standards and systems focused on the assurance of quality in the organisation. Management systems to define quality policies, objectives and their implementation. Benchmarking, Net Promoter scores

Asset management - a systematic approach to the governance and realisation of value from things that a group or entity is responsible for, over their whole life cycles

Practical observation	
Pass criteria – the apprentice will be able to:	
SCM1	Demonstrate effective management, supervising and managing resources as appropriate
Amplification	
Resources – refers to tools, equipment, materials, IT systems, personnel used in the observation	
Professional Discussion	
Pass criteria – the apprentice will know and understand:	
KCM4	The importance of commercial awareness , including the relationship with the supply chain
KCM5	The procurement process and its importance to the business and industry
Pass criteria – the apprentice will be able to:	
SCM2a	Implement project management processes and tools to effectively manage work packages such as Gantt Charts, Logic Network, PERT Chart, Product and Work Breakdown Structure, Risk Register
SCM2b	Work effectively with stakeholders
SCM2c	Comply with quality assurance processes
SCM3	Implement appropriate asset management tools to manage assets throughout their life cycle
Amplification	
Commercial awareness - is an understanding of how industries and businesses work and how internal and external factors can affect success	
Supply chain - refers to a system of organisations, people, activities, information and resources involved in moving a product or service from supplier to customer	
Procurement process - the means of finding and agreeing to terms and acquiring goods, services, or works from an external source, often via a tendering or bidding process	
Project management - tools and techniques to set up, run and oversee a project – use of project methods such as Prince2, Critical Path analysis, Gantt charts, project plans	

Work packages - a group of related tasks within a project. As they look like projects themselves, they are often thought of as sub-projects with a larger project

Stakeholders - interested parties, affected parties, shareholders, employees, customers, contractors, suppliers, buyers, pressure groups, lobbyists, trades unions, political, governmental, contractual. Board members, senior managers, focus groups, passenger/customer forums. Professional and Industry associations, financial institutions, regulators

Quality assurance - the maintenance of a desired level of quality in a service or product, by means of attention to every stage of the process of delivery or production

Core – Information

Practical observation

Pass criteria – *the apprentice will be able to:*

SCI2 Interpret and manage information, which could include **multidimensional modelling**, complex **work plans**, **technical drawings** and **schematics**, including **change control**

Amplification

Multi-dimensional modelling - the use of 2D and 3D CAD (computer-aided design) systems to visually represent an object, e.g. a station

Work plans - a tool that helps a project assign tasks, manage workflow and track the various components and milestone deadlines

Technical drawings - a drawing that visually communicates how something functions or is constructed

Schematics - the representation of the elements of a system rather than realistic pictures

Change control - the process that all requests to change the baseline scope of a project are captured, evaluated and then approved, rejected or deferred

Professional Discussion	
Pass criteria – the apprentice will know and understand:	
KCI1	The basics of working with Building Information Modelling (BIM) and the Common Data Environment
Pass criteria – the apprentice will be able to:	
SCI1	Apply BIM and Asset Information Modelling (AIM) requirements effectively
Amplification	
Building Information Modelling (BIM) - a process supported by various tools and technologies involving the generation and management of digital representations of physical and functional characteristics of places	
Common Data Environment - a single source of information used to collect, manage and disseminate documentation relating to a project	
Asset Information Modelling (AIM) - the process of collecting information gathered from all sources that support the ongoing management of an asset	

Core – Communication	
Practical observation	
Pass criteria – the apprentice will be able to:	
SCCOM1	Undertake and implement a high standard of technical work taking responsibility for efficient and effective delivery of work packages
SCCOM2	Communicate effectively across all levels
SCCOM3	Use appropriate IT systems and applications

Core – Behaviours

Practical Observation

Pass criteria – *the apprentice*:

KB1 Fosters a safe, secure and healthy working environment through personal responsibility and behaviour

KB2 Effective self-manage, prioritise and a proactively approaches work and **continuous professional development**

Amplification

Continuous professional development – refers to the process of tracking and documenting the skills, knowledge and experience gained both formally and informally as an individual works, beyond any initial training

Professional Discussion

Pass criteria – *the apprentice*:

KB3 Acts professionally, shows commitment to the industry and employer, and is an effective ambassador for the employer

KB4 Works flexibly, embraces change, handles ambiguity and accepts new ideas and ways of working

KB5 Is customer focused and is dedicated to improving the customer experience

KB6 **Effectively lead**

KB7 Is committed to equality, diversity and inclusion, and act ethically with integrity and respect

KB8 Uses effective communication skills to work collaboratively and to exchange **constructive feedback**

Amplification

Effectively lead – use of skills, techniques, transactional, transformational, charismatic, autocratic, democratic, strategic. Supporting people using coaching and mentoring approaches, performance management

Constructive feedback - supportive feedback given to individuals to help identify solutions to areas of weakness they may have. It is information specific, issue-focused and based on observations

Power

Knowledge test

Pass criteria – *the apprentice will know and understand:*

KP1	Specific health and safety regulations and best practice while working with electrical power, emergency first aid for electrical hazards, safe working at height
KP2	Electrical, electronic and mechanical engineering theories that underpin the field of power and distribution in the high speed rail context
KP3	Industry standards that cover specific skills used for overhead lines, cable jointing and substation fitting activities
KP4	Design of the electrification systems and components for a high speed rail system
KP8	The key roles of Electrical and Plant Distribution Engineers and Electrification Engineers
KP10	New technologies used on high speed rail in Britain and abroad

Amplification

Health and safety regulations – refers to Electricity at Work Regulations (1989); Control of Substances Hazardous to Health (COSHH); The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR); Health and Safety at Work etc. Act (1974); Environment Act (1995); Construction, Design and Management (CDM) Regulations 2015, etc.

Emergency first aid for electrical hazards – refers to actions for electric shock (unconsciousness, stoppage of breathing, cardiac failure), electrical burns and injuries stemming from being thrown by the supply

Safe working at height – refers to compliance with Work at Height Regulations 2005 (WAHR); taking account of weather conditions; checking that the place of work is safe and checked each time work takes place; prevention of falling objects by use of exclusion zones; storage of materials and objects safely to prevent injury if they are disturbed or collapse; plan for emergencies and rescue, e.g. agree a set procedure for evacuation; use of appropriate personal protective equipment (PPE) and safety harnesses, etc.

Electrical, electronic and mechanical engineering theories – electrical theorems to include: Ohms Law, Kirchoff’s Laws, Single-Phase and 3 Phase AC theorems, calculations involving true, reactive and apparent power, power factor correction; the nature of magnetic fields and the principles and applications of electromagnetic induction; the relationship between voltage and current in inductors, capacitors and resistors in AC circuits. Electronic theorems to include; principles and applications of semiconductor devices, diodes, transistors and thyristors; how solid-state devices are used in the

interfaces of OLE with signalling systems and in switching and isolation; the basic principles and properties of digital signals and solid state switching. Calculate the magnitude, direction and position of the line of action of the resultant and equilibrant of non-concurrent coplanar forces acting on a structure. Mechanical theories to include; calculation of the support reactions of a simply supported beam carrying at least two concentrated loads and uniformly distributed load; calculation of the induced direct stress, strain and dimensional change in component subjected to direct uniaxial loading and the shear stress and strain in a component subjected to shear loading; solve problems that require the application of kinetic and dynamic principles to determine unknown system parameters

Industry standards – Railway Industry Standards - RIS, Network Rail Regulations, Electricity at Work Regulations (1989), Railway Group Standards applicable to electrification, Railway Operation Group Standards (ROGS), Technical Specifications for Interoperability (TSI's) 18th Edition BS 7671:2018 - Requirements for Electrical Installations, IET Wiring Regulations

Overhead lines – refers to the catenary wire system that brings in the electrification supply and drops to the contact wire installation to provide a 25Kv supply to the rolling stock pantograph

Cable jointing – in-line splicing of HV voltage cables using terminal blocks and heat shrink (PVC insulator shrinks when heat applied) and cold shrink insulation (insulation tube provides insulation with no need for heating). For catenary and contact wire the span lengths of wire are joined using torque loaded in-line splices

Substation fitting – the supporting activity associated with installing substations, providing for switching equipment, protection equipment, control equipment, HV voltage wiring distribution and termination, Isolation equipment, transformer installation and cooling systems (usually provided by electrical distribution contractor)

Electrification systems – refers to the process of providing a 25Kv supply to the pantographs of rolling stock, from tensioned overhead line systems, supported by span equipment, portal equipment or cantilevers. Fed from feeder stations and sub-stations, employing booster transformers or auto-transformers to maintain the supply (depending on design). The system also incorporates components to provide switching in of span sections, section insulation and provision of emergency feeding in the event of electrical supply issues

Electrical and Plant Distribution Engineers - personnel associated with bringing in the supply to the Overhead Line Electrification (OLE) from feeder stations and substations to trackside equipment and the provision of control and protection of the incoming supply

Electrification Engineers – personnel associated with designing, planning, installation, commissioning and maintenance of Overhead Line Electrification (OLE) systems

Practical observation	
Pass criteria – <i>the apprentice will competently:</i>	
SP1	Consistently apply health and safety best practice and compliance, apply safe working at height and safety harness use and apply emergency first aid for electrical hazard
SP2	Safely, accurately and efficiently install and commission track-side and overhead power supply and transmission systems for high speed rail
SP3	Use and direct the use of lifting and access equipment
SP7	Plan, monitor, implement and maintain track-side and overhead line equipment using appropriate systems, standards, procedures and tools
SP9	Read and interpret both paper-based and digital technical design drawings, models and schematics
SP11	Accurately complete and maintain necessary documentation
Amplification	
<p>Health and safety best practice – best practice can include: the wearing of the correct level PPE for the working being undertaken; the reporting of potential hazards through close call and near-miss procedures; the carrying out of risk assessments to mitigate risks; the adoption and promotion of safe systems of work; the compliance with safety notices in work procedures; the conducting of toolbox talks to highlight safety issues; and the general adoption of employee and employer responsibilities under the Health and Safety at Work etc. Act 1974</p> <p>Safe working at height – refers to compliance with Work at Height Regulations 2005 (WAHR); taking account of weather conditions; checking that the place of work is safe and checked each time work takes place; prevention of falling objects by use of exclusion zones; storage of materials and objects safely to prevent injury if they are disturbed or collapse; plan for emergencies and rescue, e.g. agree a set procedure for evacuation; use of appropriate personal protective equipment (PPE) and safety harnesses, etc.</p> <p>Safety harness – a system of restraints that prevent the wearer from falling from a height. By wearing the belt or harness the risk of injury from a fall is greatly reduced. Requirement for wearing a safety harness stems from the Working at Height Regulations 2005 (WAHR), in general harnesses should be worn when working on an elevated platform that is 6 feet or more from ground level, with an unprotected edge</p> <p>Install and commission – install is to complete a systems installation to the point where it is fit for purpose, commission refers to the process of carrying checks on the installation to ensure it meets the design criteria and is safe to release for use</p> <p>Overhead power supply – refers to the Overhead Line Equipment (OLE) used to transmit electrical energy to the train. It can contain but is not limited to: foundations, steelwork, cantilever masts, portal systems, insulators, wire systems, tensioners, etc.</p>	

Transmission systems - refers to the means that electrical power is generated and utilised to provide a supply to the required system, for example, single-phase or three-phase AC transmission

Lifting and access equipment – refers to equipment that allows the raising of components of a structure to an elevation beyond normal reach for the purpose of installation, also for the lifting of equipment to allow transportation within site or externally. Examples include cranes, winch systems and forklifts. Access equipment is equipment and systems that allow working on areas that are restricted by height and location. Examples include raised platform systems, scaffolding arrangements, ladders and hoists

Track-side and overhead line equipment – refers to any equipment that is employed in providing electrical supplies to railway services and systems, including, for example, protection against electric shock, protection against overload, switching, isolation and status indication. Overhead line equipment is the equipment exclusively employed in the providing of overhead line electrification and includes mast structures, registration arms, cantilever arrangements, stagger setting arrangements, catenary and contact wires, tensioning equipment and cable trains

Systems, standards, procedures and tools – systems are the specific processes adopted in carrying out engineering work, for example, safe working systems, inspection systems, supervisory systems, installation and maintenance systems. Standards are the publications that detail the expected quality and conformity the work is to be carried to, for example, Network Rail standards. Procedures are the specific way that work is to be undertaken to ensure it meets the required standards. Tools are the physical items required to carry out the engineering task and can include hand-tools, pneumatic or hydraulically operated equipment, test equipment and measuring equipment

Paper-based and digital technical design drawings – paper-based drawings are drawings produced traditional technical drawing methods. Digital technical design drawings are drawings using design drawing software which can include BIM modelling

Models and schematics – models are 3D representations of the system being worked on, schematics are a simplified representation of a system to allow easier understanding of how it operates and to facilitate troubleshooting

Documentation – any paperwork that details how work is to be carried out, recorded and signed off

Professional discussion	
Pass criteria – the apprentice will know and understand:	
KP5	Power supply , transmission, protection and isolation devices for high speed rail
KP6	Planning, installation and maintenance of OLE and related equipment
KP7	The process of managing electrification from receipt from the National Grid transformers to use at track-side or Overhead Line Equipment (OLE)
KP9	Fault-finding techniques , common faults and repair procedures
Pass criteria – the apprentice will competently:	
SP4	Safely, accurately and efficiently install and commission track-side and overhead power supply and transmission systems for high speed rail
SP5	Erect and direct the erection of different types of overhead line structures , pre-fabrication and installation of main structure and small part steelwork and running wire systems
SP6	Take account of sectioning , insulation , registration and in-span components and the installation, enhancement and renewal of earthing and bonding
SP8	Conduct dynamic risk assessment for non-routine occurrences
SP10	Effectively supervise teams and allocate work schedules
Amplification	
<p>Power supply – a source of DC or AC electrical power to the particular system</p> <p>Protection – the means of providing protection against electric shock or circuit protect in the event of current overloads due to fault conditions. Protection also includes the measures employed in the event of over or under frequency to ensure the system continues to operate or is isolated to prevent component damage</p> <p>Isolation devices – manually or remotely operated devices employed to provide isolation to enable maintenance and/or diagnostic work to be carried out on an electrical system in the un-energised state</p> <p>OLE (Overhead Line Equipment) – refers to the equipment constructed above the line to transfer electrical energy to the train, it can include: foundations, steelwork, cantilever masts, portal systems, insulators, wire systems, tensioners, etc.</p>	

Managing electrification – systems engineering and project management techniques employed in the successful implementation of an electrification project. Specifying and monitoring where supplies to the trackside feeder stations are obtained from, type of feeder station to be employed and the spacing of feeder stations for electrification project. Specification of the supply methods, distribution design and installation methods for supplies to electrification. Defining connection methods, protection and isolation strategies

Fault-finding techniques – the techniques employed to locate faults in electrification systems, can include half-split method, continuity testing, voltage checks, non-destructive testing and insulation testing

Common faults – faults which commonly occur in electrical installations, can include open circuits, short circuits, insulation faults, nuisance tripping, and cross-connection

Repair procedures – procedures that are required to be followed to allow a repair to be achieved

Overhead line structures – the structures associated with electrification and include masts, gantries, portals, spans, cantilevers and anchoring arrangements

Pre-fabrication and installation of main structure – refers to the work carried out on a component for Overhead Line Equipment (OLE) before it is used as part of the installation. Installation is the fitting of the main structural item into the electrification installation

Small part steelwork – refers to the work carried out on small parts, e.g. pre-fitting, ensuring a correct fit is achieved. For example, filing, drilling, shaping of brackets and plates

Running wire systems – refers to the wire systems that carry the electricity to the train, can include: tensioners, catenary wire, droppers and contact wire

Sectioning – refers to how the line is broken into electrically separated parts allowing for maintenance to take place without the need to turn off the whole system

Insulation – refers to a material of resistivity (which has an extremely high resistance to current flow) and low conductivity (will not readily conduct current). Insulators are used to isolate areas from live supplies to provide for protection from contact with live components. In Overhead Line Equipment (OLE), ceramic insulators are readily employed, though more modern systems have adopted polymeric plastic insulation. Insulation is also adopted in a variety of PVC and rubber composites in High Voltage cables to provide isolation protection from the conducting core

Registration – refers to the process of ensuring the catenary and contact wire profile and position is maintained for all spans of an Overhead Line Equipment (OLE) installation, this includes maintaining the designed stagger of the catenary systems over the normal line of the track for tangent (straight), radial (curved) sections and maintaining the designed profiles and clearances of the contact wire

In-span components – refers to the components required to correctly install, support and register a span of Overhead Line Equipment (OLE) and are the components which are employed to carry the OLE span between frames and portals. They can include the following: mounting brackets and fixings, support tubes, registration arms, registration heels, catenary wires, droppers, contact wires, mid-point anchors, tensioning arrangements, connectors, splices, turnbuckles and section isolators

Earthing – refers to the process of providing a very low resistance return path to complete a circuit that is supplied with voltage source (known as functional earthing). In electrification, the 25kV supply to the contact wire is provided by a feeder station. The pantograph draws current from this supply to operate its traction motors, the connection to earth is achieved employing the metal rail (running rail) as a connection that allows earth returns to an earthed centre tap connection at the feeder station output winding. More critically, earthing is also the means of protection from the risk of electric shock by providing a low resistance path to an earth connection in the event of an electrical short-circuit fault in an energised system, allowing protection devices to operate quickly and disconnect the supply (protective earthing)

Bonding – refers to the process of interconnecting metallic components to prevent one component from achieving a higher build-up of voltage potential than an adjacent component allowing an undesirable and potentially dangerous flow of current to occur. Bonding is therefore used to reduce the risk of electric shocks to anyone who may touch two separate metal parts especially when there is a fault somewhere in the Overhead Line Equipment (OLE) installation. Bonding maintains metallic components at the same electrical potential and is applied to track sections, OLE gantries and frames by a series of bonds between track sections and metallic OLE structures. Bonding also plays a major role in ensuring that effective protective earthing is achieved in electrical installations where a fault may have occurred

Dynamic risk assessment – refers to assessments made in situations at a work or trackside location, to mitigate the risks that have become identified when undertaking a specific task, that have not been previously included in risk assessments. It is the process of being able to put safety measures in place while on site, allowing work to be continued without delays

Work schedules – refer to the instructions given to identify the amount time that has been allocated to a task and the amount of time a person is expected to spend on the task. They allow for the planning of work by identifying the hours of operation by individuals on a task, along with identification of what tasks need to be completed and in what timeframes. Shift work schedules divide the day into shifts and assign employees to work set periods of time

Additional practical observation grading

Merit

To achieve a merit in the observation, apprentices must achieve the pass criteria and in addition, demonstrate in **more than one context**:

- OBM1 Demonstrate systems thinking taking account of multiple disciplines
- OBM2 Management of resources including time and physical resources across a range of activities
- OBM3 Interpret and manage a variety of information
- OBM4 Demonstrate competency of technical work in a range of contexts
- OBM5 Demonstrate effective use of appropriate IT systems and applications in a range of contexts

Distinction

To achieve a distinction in the observation, apprentices must achieve the merit criteria and in addition, provide examples of the **positive impact** of their:

- OBD1 Systems thinking, providing examples of interface management
- OBD2 Management of resources to ensure positive outcomes of projects or business objectives
- OBD3 Use of complex data to inform decision making and create a positive impact
- OBD4 Deployment of IT hardware and applications to provide a positive impact

Additional professional discussion grading

Merit

To achieve a merit the apprentice must achieve the pass criteria and in addition, demonstrate in a **range of contexts**:

- PDM1 Leadership of people and projects
- PDM2 Improvement of customer experience for both internal and external customers
- PDM3 The ability to adapt to new technologies and ways of working
- PDM4 Demonstrate communication appropriate to a variety of audiences

Distinction

To achieve a distinction in the professional discussion, apprentices must achieve the merit criteria and in addition, provide examples of the **positive impact** of their:

- PDD1 Leadership of people and projects
- PDD2 Customer service by implementing innovative strategies
- PDD3 Use of new technologies and ways of working
- PDD4 Communication techniques in the workplace, including positive impacts on the business

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Assessment summary

The end-point assessment for High Speed Rail and Infrastructure Advanced Technician (power pathway) is made up of 3 components which must be taken the following order:

1. 2 x 1-hour written tests consisting of multiple-choice and open response/short answer questions
2. 3-hour practical observation
3. 90-minute professional discussion

As an employer/training provider, you should agree a plan and schedule with the apprentice to ensure all assessment components can be completed effectively.

Each component of the end-point assessment will be assessed against the appropriate criteria laid out in this guide, which will be used to determine a grade for each individual component.

Knowledge tests

- To gain a pass, apprentices must achieve 60%
- To gain a merit, apprentices must achieve 70%
- To gain a distinction, apprentices must achieve 80%

The tests may be delivered online or be paper-based and must be in a controlled environment with invigilation.

Practical observation

- To gain a pass in the practical observation, all pass criteria must be achieved
- To gain a merit in the practical observation, apprentices must achieve the pass criteria and demonstrate the merit criteria in **more than one context**
- To gain a distinction in the practical observation, apprentices must achieve the pass and merit criteria and provide examples of their **positive impact** for all distinction criteria

Professional discussion

- To gain a pass in the professional discussion, all pass criteria must be achieved
- To gain a merit in the professional discussion, apprentices must achieve the pass criteria and demonstrate the merit criteria in a **range of contexts**
- To gain a distinction in the professional discussion, apprentices must achieve the pass and merit criteria and provide examples of their **positive impact** for all distinction criteria

Grading

The overall grade for the apprentice is as follows:

Pass	Requires the apprentice to pass each component
Merit	Requires the apprentice to achieve at least a merit in each component
Distinction	Requires the apprentice to achieve a distinction in each component

Retake and resit information

If an apprentice fails an end-point assessment method, it is the employer, provider and apprentice's decision whether to attempt a resit or retake. If a **resit** is chosen, please call the Highfield scheduling team to arrange the resit. If a **retake** is chosen, the apprentice will require a period of further learning and will need to complete a new gateway readiness meeting and report. Once this is completed, please call the Highfield scheduling team to arrange the retake.

The resit or retake is normally expected to take place after all the required assessments have been taken and the individual assessment results and overall apprenticeship result has been given to the apprentice.

When undertaking a resit or retake, the assessment method(s) will need to be re-attempted in full, regardless of any individual assessment criteria that were passed on any prior attempt. The EPA Report will contain feedback on areas for development and resit or retake guidance. If resits or retakes are required, apprentices should complete resits within 12 months. There is no limit to the number of resits or retakes within the 12 months.

An apprentice requiring a resit or a retake may still achieve a merit or distinction. Apprentices who achieve a pass grade cannot resit or retake the EPA to achieve a higher grade.

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Assessing the knowledge test

The following areas (knowledge) of the High Speed Rail and Infrastructure Advanced Technician standard will be assessed by two 1-hour, 40-mark knowledge tests, each consisting of 20 multiple-choice and 2 open-response/short-answer questions. Each multiple-choice question is worth 1 mark and each open-response/short-answer question is worth a total of 10 marks.

The pass mark for each test is 24/40 (60%), merit is 28/40 (70%) and distinction is 32/40 (80%).

The topics covered within the tests are listed below.

Core – consisting of 20 multiple-choice and 2 open-response/short-answer questions

- Health and safety
- Context
- Design
- Management

Pathway - consisting of 20 multiple-choice and 2 open-response/short-answer questions

- Power

Before the assessment

- While on-programme, the employer/training provider should brief the apprentice on the areas to be assessed by the knowledge test
- In readiness for end-point assessment, the apprentice should complete a sample test; mock assessments are available to download from the Highfield Assessment website and may be used for this purpose. Mock tests are available in paper-based format, or on the mock e-assessment system.

Knowledge test criteria

Core - Health and safety	
Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria
KCHS1 The critical importance of safety and security in the conventional and the high speed railway industries, the principles of safe by design, system assurance and health and safety legislation	<ul style="list-style-type: none"> • Evaluate the critical importance of safety and security in the conventional and high speed rail industries • Explain the principles of safe by design in the high speed rail industry • Describe the role of systems assurance in the rail industry • Clarify the impact of health and safety legislation on the rail industry
KCHS2 The relationships of health and welfare strategies with safety in the workplace	<ul style="list-style-type: none"> • Describe the purpose of health and welfare strategies in ensuring a safe railway • Describe the key health and welfare considerations for rail employees • Explain the impact of positive health and welfare policies on the rail industry
KCHS3 The relevance of standards, policy, regulation and guidelines for the UK rail industry	<ul style="list-style-type: none"> • Describe the standards, policies, regulations and guidelines applicable to the UK rail industry • Explain the relevance of standards, policy, regulation and guidelines for the UK rail industry • Explain how railway standards, policy, regulation and guidelines have impacted on the UK rail industry
KCHS4 Risk assessment and hazard analysis identification, management and mitigation	<ul style="list-style-type: none"> • Evaluate effective risk assessment management principles • Clarify the process of hazard analysis • Explain effective hazard mitigation methods in the rail industry

Core - Context

Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria
KCC4 Appropriate fundamental engineering principles	<ul style="list-style-type: none"> • Describe how engineering principles are applied to tasks • Describe the basic properties of materials and their interaction • Explain how geometry and trigonometry principles are applied • Describe how areas and volumes are calculated and their application in the development of the railway • Explain the physics theories that apply to engineering problems • Describe electrical and electronic engineering theories that underpin the field of power and distribution • Describe metallurgical principles and how they impact railway design, operation and maintenance

Core – Design

Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria
KCD1 The relevance and importance of sustainability, environmental, social and economic considerations in the development of a high speed railway	<ul style="list-style-type: none"> • Analyse the importance of incorporating sustainability into each stage of high speed rail development • Clarify the importance of environmental considerations in the development of high speed rail • Evaluate the social impacts of high speed rail development on communities along the proposed route • Describe the economic considerations required to legitimise the development of high speed rail
KCD2 How the rail network system is designed, built, installed, operated, maintained, renewed and decommissioned	<ul style="list-style-type: none"> • Describe design requirements and links to feasibility analysis • Explain the design requirements control process (requirements mapping) throughout a project lifecycle including the use of appropriate software and hardware

	<ul style="list-style-type: none"> Describe the design process lifecycle from conception to decommissioning
Core – Management	
Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria
KCM1 The requirements for, and characteristics of, leadership, collaboration and management	<ul style="list-style-type: none"> Describe and differentiate between the concepts of leadership and management Evaluate different leadership styles to lead multiple and remote teams and manage team leaders Clarify the benefits of collaboration across multiple teams Describe collaborative tools and working techniques and the value of sharing best practice
KCM2 The principles of effective project management, stakeholder management and quality management	<ul style="list-style-type: none"> Explain effective project management and its role in the organisation to achieve organisational objectives State the role of stakeholders in the high speed rail industry Explain the impact of stakeholder management to the successful delivery of any project, programme or activity Explain how effective quality control ensures that an organisation, product or service is consistent
KCM3 The principles of asset management	<ul style="list-style-type: none"> Describe the principles of asset management

Power

Power	
Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria
KP1 Specific health and safety regulations and best practice while working with electrical power, emergency first aid for electrical hazards, safe working at height	<ul style="list-style-type: none"> • Describe the specific health and safety regulations and best practice applicable to electrical power • Describe the emergency first aid procedures for electrical hazards • Describe the procedures for safe working at height
KP2 Electrical, electronic and mechanical engineering theories that underpin the field of power and distribution in the high speed rail context	<ul style="list-style-type: none"> • Describe the relevant electrical principles for power installations and electrification systems applications • Describe the relevant electronic principles for the interfaces with Command, Control and Communication (CCC) and electronic switching devices • Explain the relevant mechanical principles to the process of OLE (Overhead Line Equipment) installation
KP3 Industry standards that cover specific skills used for overhead lines, cable jointing and substation fitting activities	<ul style="list-style-type: none"> • Describe the Rail Group Standards (RGS) that relate to OLE • Explain how Network Rail Standards apply to power installations and electrification systems • Describe HS2 power installation and electrocution specification standards
KP4 Design of the electrification systems and components for a high speed rail system	<ul style="list-style-type: none"> • Describe the basic considerations of OLE design and the engineering lifecycle for power installations and electrification system projects • State the components required for the design of power installations and electrification requirements to meet HS2 specifications
KP8 The key roles of Electrical and Plant Distribution Engineers and Electrification Engineers	<ul style="list-style-type: none"> • Explain the role of Electrical and Plant Distribution Engineers in the context of high speed rail • Explain the role of Electrification Engineers in the context of high speed rail
KP10 New technologies used on high speed rail in Britain and abroad	<ul style="list-style-type: none"> • Describe the new power technologies used on high speed rail in Britain and abroad

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Assessing the practical observation

This 3-hour observation will require Highfield Assessment to observe the apprentice within a real-work environment or within a simulated environment, if necessary.

The observation will be carefully designed to ensure that they provide the apprentice with sufficient opportunities to demonstrate the skills and behaviours to be assessed.

The practical observation will include a 15-minute briefing session. During this session, the apprentice should be encouraged to ask questions and to confirm that they understand what is expected of them.

The practical observation will reflect a frequent scenario from the apprentice's work activities and will relate to the specific role they are working in. A Scenario Allocation Form must have been completed and submitted to Highfield at Gateway to outline the apprentice's place of work and job role to ensure the allocated scenario is suitable for the apprentice.

The assessor will ask the apprentice a range of supplementary questions during the observation designed to enable the apprentice to demonstrate their knowledge in more than one context and evidence the positive impacts they have made.

Examples of supplementary questions include:

- how do you ensure you keep your knowledge up to date and how do you evidence this?
- talk me through why you need to perform this particular task.
- what data do you need to analyse and how does this inform your decisions?
- why are you using this particular software for this task?
- what positive impacts have you made to this process?

Simulation

Where it is identified that simulation is the most appropriate means of assessment, this will be planned in advance. Simulation is intended to be either:

- the use of technology such as virtual or augmented reality to allow the apprentice to demonstrate competence in required tasks
- working with real industry equipment to address simulated issues, for example, fault finding using real bogies, where the fault is simulated

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Practical observation criteria

Core - Health and safety	
Pass criteria – <i>the apprentice will be able to:</i>	Indicative assessment criteria:
SCHS1a Develop and maintain an effective safety culture	<ul style="list-style-type: none"> • Demonstrate compliance with health and safety procedures • Demonstrate use of IT hardware and applications for a positive effect on health and safety culture
SCHS1b Embed a culture of health, welfare and safety compliance to ensure the health and safety of employees, customers, visitors and members of the public	<ul style="list-style-type: none"> • Demonstrate ownership of health, welfare and safety compliance relating to the task • Utilise physical resources to ensure health, safety and welfare is maintained
SCHS1c Rigorously apply security procedures	<ul style="list-style-type: none"> • Demonstrate compliance with security procedures pre-task • Demonstrate effective use of IT systems to check for security issues
SCHS2a Apply rigorous health and safety practices; comply with legislation and safety processes	<ul style="list-style-type: none"> • Ensure all health and safety instructions are correctly adhered to • Ensure all work is signed for in accordance with legislative requirements at the end of task
SCHS3 Comply with relevant standards and regulations	<ul style="list-style-type: none"> • Demonstrate compliance with relevant standards and regulations throughout tasks
SCHS4 Identify and manage risk, and prepare contingency plans	<ul style="list-style-type: none"> • Carry out appropriate risk assessment activities • Prepare contingency plans for emergencies, including the use of IT systems

Core - Context

Pass criteria – <i>the apprentice will be able to:</i>		Indicative assessment criteria:
SCC1	Apply effective systems engineering practice, considering the interfaces between work packages and promoting and maintaining effective communications between disciplines	<ul style="list-style-type: none"> • Demonstrate application of systems engineering practice when considering project activities with multidisciplinary teams • Ensure systems thinking when dealing with interfaces between work packages • Manage and maintain effective communication between disciplines

Core - Management

Pass criteria – <i>the apprentice will be able to:</i>		Indicative assessment criteria:
SCM1	Demonstrate effective management, supervising and managing resources as appropriate	<ul style="list-style-type: none"> • Carry out supervisory or management tasks and responsibilities at a level appropriate to the role • Use resources efficiently in line with the organisation's objectives

Core – Information

Pass criteria – <i>the apprentice will be able to:</i>		Indicative assessment criteria:
SCI2	Interpret and manage information, which could include multidimensional modelling, complex work plans, technical drawings and schematics, including change control	<ul style="list-style-type: none"> • Interpret and manage information, including multidimensional modelling, complex work plans, technical drawings, schematics • Demonstrate how the change control process is used within a project

Core - Communication

Pass criteria – <i>the apprentice will be able to:</i>	Indicative assessment criteria:
SCCOM1 Undertake and implement a high standard of technical work taking responsibility for efficient and effective delivery of work packages	<ul style="list-style-type: none"> Undertake technical work to deliver work packages effectively and efficiently
SCCOM2 Communicate effectively across all levels	<ul style="list-style-type: none"> Demonstrate effective communication at all levels
SCCOM3 Use appropriate IT systems and applications	<ul style="list-style-type: none"> Demonstrate the use of appropriate IT systems and applications

Core - Behaviours

Pass criteria – <i>the apprentice:</i>	Indicative assessment criteria:
KB1 Fosters a safe, secure and healthy working environment through personal responsibility and behaviour	<ul style="list-style-type: none"> Demonstrates a safe, secure and healthy working environment through personal responsibility and behaviour
KB2 Effective self-manage, prioritise and a proactively approaches work and continuous professional development	<ul style="list-style-type: none"> Demonstrates ability to self-manage, prioritise and a proactive approach to work Demonstrates commitment to continuous professional development

Power

Pass criteria – <i>the apprentice will competently:</i>	Indicative assessment criteria:
<p>SP1 Consistently apply health and safety best practice and compliance, apply safe working at height and safety harness use and apply emergency first aid for electrical hazard</p>	<ul style="list-style-type: none"> • Demonstrate health and safety best practice when conducting power specialisation tasks in line with relevant legislation and working procedures • Demonstrate safe working at height procedures in line with relevant legislation and safe working systems • Demonstrate effective emergency first aid techniques for injuries caused by electrical hazards
<p>SP2 Safely, accurately and efficiently install and commission track-side and overhead power supply and transmission systems for high speed rail</p>	<ul style="list-style-type: none"> • Demonstrate safe, effective and efficient installation and commission of track-side and overhead power supplies for high speed rail • Demonstrate safe, effective and efficient installation and commission of transmission systems for high speed rail
<p>SP3 Use and direct the use of lifting and access equipment</p>	<ul style="list-style-type: none"> • Conduct risk assessment for lifting and access operations considering the operational requirement for OLE installation tasks • Conduct Overhead Line Equipment (OLE) installations using the appropriate lifting and access equipment • Demonstrate effective communication with lifting and access equipment operators using approved signalling methods
<p>SP7 Plan, monitor, implement and maintain track-side and overhead line equipment using appropriate systems, standards, procedures and tools</p>	<ul style="list-style-type: none"> • Demonstrate the planning of track-side equipment installation and OLE against an approved project or installation specification • Demonstrate a review of scheduled work and take appropriate action to resolve occurring engineering problems • Demonstrate the Implementation of the required installation, or of the maintenance to, appropriate working systems
<p>SP9 Read and interpret both paper-based and digital technical design drawings, models and schematics</p>	<ul style="list-style-type: none"> • Demonstrate the interpretation of general schematic diagrams including British Standard (BS) symbols, power and OLE specific drawings

	<ul style="list-style-type: none"> • Demonstrate the interpretation of assembly and installation documentation to enable correct construction and fitting of mechanical parts • Demonstrate the interpretation and utilisation of digital design drawings and models to enhance understanding of design specification concepts
SP11 Accurately complete and maintain necessary documentation	<ul style="list-style-type: none"> • Demonstrate the validation of relevant renewal, installation or enhancement documentation for a task • Demonstrate measures to safeguard documentation against damage or loss • Demonstrate the completion of all required areas of electronic/paper-based maintenance documentation

Additional practical observation grading

Merit

To achieve a merit in the observation, apprentices must achieve the pass criteria and in addition, demonstrate in **more than one context**:

- OBM1 Demonstrate systems thinking taking into account of multiple disciplines
- OBM2 Management of resources including time and physical resources across a range of activities
- OBM3 Interpret and manage a variety of information
- OBM4 Demonstrate competency of technical work in a range of contexts
- OBM5 Demonstrate effective use of appropriate IT systems and applications in a range of contexts

Distinction

To achieve a distinction in the observation, apprentices must achieve the merit criteria and in addition, provide examples of the **positive impact** of their:

- OBD1 Systems thinking, providing examples of interface management
- OBD2 Management of resources to ensure positive outcomes of projects or business objectives
- OBD3 Use of complex data to inform decision making and create a positive impact
- OBD4 Deployment of IT hardware and applications to provide a positive impact

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Assessing the professional discussion

The professional discussion is a 90-minute structured meeting between the apprentice and the assessor.

During the last 6 months of the apprenticeship, the apprentice will complete a 4000-word work project related to their specialism. The report must be accompanied by the Written Submission Sheet which is available to download from the Highfield Assessment website.

The apprentice will be able to draw their responses from their work project to provide supporting evidence, although the project itself will **not** be assessed as it was completed on-programme. This will provide the assessor with the opportunity to draw out the apprentice's broader understanding of the principles and thinking behind their approach to the project and their learning from this. However, the assessor will focus the discussion on enabling the apprentice to provide evidence of the relevant knowledge, skills and behaviours from the standard.

The assessor will receive a copy of the project in advance to inform preparation for the professional discussion. The professional discussion will be planned in advance to allow the apprentice time to prepare. The independent assessor will record their findings in a formal report.

The professional discussion will take place in a controlled environment, i.e. a quiet room.

Where the discussion is not face to face, Highfield Assessment will ensure adequate controls are in place to maintain fair and accurate assessment and have robust procedures in place to authenticate the learner's identity.

Before the assessment:

Employers/training providers should:

- plan the professional discussion to allow the apprentice the opportunity to demonstrate each of the required standards
- ensure the apprentice knows the date, time and location of the assessment
- ensure the apprentice knows which criteria will be assessed (outlined on the following pages)
- encourage the apprentice to reflect on their experience and learning on-programme to understand what is required to meet the standard and identify real-life examples

- be prepared to provide clarification to the apprentice and signpost them to relevant parts of their on-programme experience as preparation for this assessment

Professional discussion – mock assessment

It is the employer/training provider's responsibility to prepare apprentices for their end-point assessment and Highfield recommend that they experience a mock professional discussion in preparation for the real thing. The most appropriate form of mock assessment will depend on the apprentice's setting and the resources available at the time.

When designing a mock assessment, the employer/training provider should consider the following elements:

- the mock professional discussion should take place in a suitable location
- a 90-minute time slot should be available for the complete professional discussion if it is intended to be a complete mock assessment covering all relevant standards, however, this time may be split up to allow for progressive learning
- consider an audio recording of the mock and consider allowing the mock to be observed by other apprentices, especially if it is not practicable for the employer/training provider to carry out a separate mock assessment with each apprentice
- ensure that the apprentice's performance is assessed by a competent trainer/assessor, and that feedback is shared with the apprentice, to complete the learning experience; mock assessment sheets are available to download from the Highfield Assessment website and may be used for this purpose
- ensure the questions asked are designed to cover the assessment criteria in the next section
- structured 'open' questions should be used as part of the professional discussion which do not lead the candidate but allows them to express their knowledge in a calm and comfortable manner, for example:
 - what are the differences between conventional and high speed rail systems?
 - what human factors do designers need to take into consideration when designing a high speed railway project?
 - tell me how you would diagnose faults in an electrification system

- talk me through the technical information and specifications required to install track-side equipment and OLE (Overhead Line Equipment)

Professional discussion criteria

Core - Health and safety	
Pass criteria – <i>the apprentice will be able to:</i>	Indicative assessment criteria:
SCHS2b Design safety into all aspects of the rail network, accounting for end-user requirements	<ul style="list-style-type: none"> • Explain the concept of designing safety into all aspects of the rail network • Describe a systems approach to the concept of safety by design • Discuss how a systems approach to safety by design will make cost savings on infrastructure projects
Core - Context	
Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria:
KCC1 The context and scope of high speed rail in the UK and internationally, and its integration into the wider transportation system	<ul style="list-style-type: none"> • Discuss the context of high speed rail in the overall UK transport infrastructure and operation • Discuss the context and scope of high speed rail internationally • Describe a working knowledge of the UK rail network and how high speed rail development is incorporated
KCC2 The distinction and interface between conventional and high speed rail	<ul style="list-style-type: none"> • Discuss the differences between conventional and high speed railway • Describe the interface between conventional and high speed railway
KCC3 The role of specialist areas within conventional and high speed rail; civil engineering, track systems, traction and rolling stock, command, control and communication, power, digital and information operations, business management, systems engineering and integration	<ul style="list-style-type: none"> • Analyse the role of the individual’s specialism in the design, construction and maintenance of conventional and high speed railways • Discuss how other specialisms interface within conventional and high speed railways

Core - Design

Pass criteria – <i>the apprentice will know and understand:</i>		Indicative assessment criteria:
KCD3	The impact of ergonomics and human factors on the design and operation of the railway	<ul style="list-style-type: none"> Describe how ergonomics and human factors affect the design and operation of the railway
KCD4	The importance of forward thinking to future innovation, technology and ways of working	<ul style="list-style-type: none"> Discuss the importance of forward thinking with regards to future innovation, technology or ways of working
Pass criteria – <i>the apprentice will be able to:</i>		Indicative assessment criteria:
SCD1	Embed the principles of sustainability and environmental considerations into the design, development, installation and operation of high speed rail projects	<ul style="list-style-type: none"> Describe environmental and sustainability considerations in the design of high speed railways Discuss how these considerations are maintained through the development, installation and operation of high speed railways
SCD2	Design and implement innovative solutions using new technologies to improve efficiency, cost, effectiveness, customer service and safety to work-based problems	<ul style="list-style-type: none"> Discuss a contribution to innovative solutions using new technologies to solve work-based problems

Core - Management

Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria:
KCM4 The importance of commercial awareness, including the relationship with the supply chain	<ul style="list-style-type: none"> • Discuss the concept of commercial awareness and how this relates to high speed rail • Explain the importance of working with the supply chain in the industry
KCM5 The procurement process and its importance to the business and industry	<ul style="list-style-type: none"> • Discuss how procurement processes are important to the business and industry
Pass criteria – <i>the apprentice will be able to:</i>	Indicative assessment criteria:
SCM2a Implement project management processes and tools to effectively manage work packages such as Gantt Charts, Logic Network, PERT Chart, product and work breakdown structures, risk registers	<ul style="list-style-type: none"> • Use project management processes, tools and techniques to effectively manage work packages
SCM2b Work effectively with stakeholders	<ul style="list-style-type: none"> • Use effective approaches towards working with stakeholders
SCM2c Comply with quality assurance processes	<ul style="list-style-type: none"> • Utilise effective methods to comply with quality assurance processes
SCM3 Implement appropriate asset management tools to manage assets throughout their lifecycle	<ul style="list-style-type: none"> • Discuss the effective use of asset management tools to manage assets throughout their lifecycle

Core – Information

Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria:
KCI1 The basics of working with building information modelling (BIM) and the common data environment	<ul style="list-style-type: none"> • Discuss the basics of working with building information modelling (BIM) and the common data environment
Pass criteria – <i>the apprentice will be able to:</i>	Indicative assessment criteria:
SCI1 Apply BIM and asset information modelling (AIM) requirements effectively	<ul style="list-style-type: none"> • Explain how to apply building information modelling (BIM) requirements effectively • Describe how to apply asset information modelling (AIM) requirements effectively

Core – Behaviours

Pass criteria – <i>the apprentice</i>:		Indicative assessment criteria:
KB3	Acts professionally, shows commitment to the industry and employer, and is an effective ambassador for the employer	<ul style="list-style-type: none"> • Presents a professional attitude and commitment to the industry and their employer • Demonstrates that they are an effective ambassador for their employer
KB4	Works flexibly, embraces change, handles ambiguity and accepts new ideas and ways of working	<ul style="list-style-type: none"> • Reflect on taking a flexible approach and embracing change • Discuss handling ambiguity and accepting new ways of working
KB5	Is customer-focused and is dedicated to improving the customer experience	<ul style="list-style-type: none"> • Discuss taking a positive approach to dealing with customers • Discuss personal approach to improving the customer experience
KB6	Effectively lead	<ul style="list-style-type: none"> • Consider their impact on others and how to adopt an appropriate style of leadership • Reflects on own leadership style and seeks feedback to continually develop as a leader
KB7	Is committed to equality, diversity and inclusion, and act ethically with integrity and respect	<ul style="list-style-type: none"> • Demonstrates commitment to equality, diversity and inclusion • Discuss an ethical approach with integrity and respect towards others
KB8	Uses effective communication skills to work collaboratively and to exchange constructive feedback	<ul style="list-style-type: none"> • Discuss effective communication skills when working collaboratively • Discuss effective communication skills to exchange constructive feedback

Power

Power	
Pass criteria – <i>the apprentice will know and understand:</i>	Indicative assessment criteria:
KP5 Power supply, transmission, protection and isolation devices for high speed rail	<ul style="list-style-type: none"> • Discuss the various components and principles of operation for the transmission of the National Grid to line side feeder stations • Discuss the transmission methods and principles of operation for supplies from line-side feeder stations to Overhead Line Equipment (OLE) and auto-transformer booster stations (if applicable) • Discuss the use of isolation devices in the context of high speed rail
KP6 Planning, installation and maintenance of OLE and related equipment	<ul style="list-style-type: none"> • Discuss the planning, installation and maintenance of OLE and related equipment
KP7 The process of managing electrification from receipt from the National Grid transformers to use at track-side or Overhead Line Equipment (OLE)	<ul style="list-style-type: none"> • Discuss the National Grid and Network Rail energisation and isolation procedures for supplies to line-side feeder stations • Describe the methods and procedures for confirming the safe isolation of the supply • Discuss the process for the reporting of electrification faults and failures to the appropriate network and supply operators and managers
KP9 Fault-finding techniques, common faults and repair procedures	<ul style="list-style-type: none"> • Describe the fault-finding techniques for power and electrification systems • Discuss the common faults associated with power, electrification components and OLE • Describe the repair procedures designed to correct failures in power, electrification components and OLE
Pass criteria – <i>the apprentice will competently:</i>	Indicative assessment criteria:
SP4 Safely, accurately and efficiently install and commission track-side and overhead power supply and transmission systems for high speed rail	<ul style="list-style-type: none"> • Discuss the technical information and specifications required to install track-side equipment and OLE • Discuss how to safely, accurately and efficiently install track-side and overhead power supply and transmission systems

		<ul style="list-style-type: none"> Describe the various testing methods required to enable the commissioning of electrical installations
SP5	Erect and direct the erection of different types of overhead line structures, pre-fabrication and installation of main structure and small part steelwork and running wire systems	<ul style="list-style-type: none"> Discuss the interpretation of installation specifications to effectively direct the erection of OLE structures for track sections in accordance with HS2 requirements Describe the use of engineering techniques to carry out the erection of overhead line structures and running wire systems Describe the post-installation inspections required to verify compliance against the project specification
SP6	Take account of sectioning, insulation, registration and in-span components and the installation, enhancement and renewal of earthing and bonding	<ul style="list-style-type: none"> Describe how to identify the sectioning regime for OLE installations from installation drawings Discuss the approved methods for installing appropriate insulators to provide electrical isolation from live components of OLE installations Describe the visual inspections required for the electrical testing and replacement of electrification earthing and bonding arrangements
SP8	Conduct dynamic risk assessment for non-routine occurrences	<ul style="list-style-type: none"> Describe the process of conducting a dynamic risk assessment for non-routine occurrences
SP10	Effectively supervise teams and allocate work schedules	<ul style="list-style-type: none"> Discuss the effective supervision of teams and the allocation of work schedules to the appropriate team members

Additional professional discussion grading

Merit

To achieve a merit the apprentice must achieve the pass criteria and in addition, demonstrate in a **range of contexts**:

- PDM1 Leadership of people and projects
- PDM2 Improvement of customer experience for both internal and external customers
- PDM3 The ability to adapt to new technologies and ways of working
- PDM4 Demonstrate communication appropriate to a variety of audiences

Distinction

To achieve a distinction in the professional discussion, apprentices must achieve the merit criteria and in addition, provide examples of the **positive impact** of their:

- PDD1 Leadership of people and projects
- PDD2 Customer service by implementing innovative strategies
- PDD3 Use of new technologies and ways of working
- PDD4 Communication techniques in the workplace, including positive impacts on the business

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