L3 EPA Electrical Power Protection and Plant Commissioning Engineer

EPA Specification Section 4 – Amplification and Guidance

Contacts

This specification has been designed to provide all the advice and guidance you need to prepare yourself and your apprentices for end-point assessment. However, if you have any further questions please contact the EUIAS Help Desk using one of the following:

Help Desk email: enquiries@euias.co.uk

Help Desk telephone: 0121 713 8310

The Electrical Power Protection and Plant Commissioning Engineer standard in detail

The Electrical Power Protection and Plant Commissioning Engineer consists of:

- Technical Knowledge (11 elements)
- Skills (10 elements)
- Behaviours (6 elements)

The following pages list each of the elements of the standard and additional amplification and guidance from EUIAS on the range and depth expected.

Knowledge: Amplification and Guidance	EPA
TK1 A comprehensive understanding of UK electrical power systems	**KA, TI**
Including: • The range of system voltages found on UK power networks and how they are represented on network diagrams • The types of high voltage apparatus used on power networks and their operational symbols • The types and purpose of network transformers, including typical vector groupings and the methods used for voltage control • The purpose and operational capabilities of network circuit breakers, including their method of operation and typical fault activation sequence • The types of electrical relay used for the protection of power networks, including their operating characteristics and typical settings • The purpose of “electrical discrimination” and the methods and types of apparatus used to achieve it on the network • The requirements and methods used for earthing substations, the dangers which can arise, and the methods used to manage them • The effect of load on the electrical network including the methods and equipment used to monitor and control its effects	

Knowledge: Amplification and Guidance	EPA
• The factors which determine the circuit ratings of network apparatus, including underground cables and operational switchgear	
TK2 The application and operation of system plant & equipment	**TI**
Application of knowledge to: • Influence and / or organise the planning of protection and commissioning projects using company equipment and methodology • Conduct protection and / or commissioning operations on relevant plant and equipment • Gain further technical information / specifications about plant and equipment which is being worked on during projects **Plant and equipment** such as circuit breakers, switchgear, relays, transformers, isolators, resistors **Operations** such as operating cycles, safe isolation requirements	
TK3 Fault analysis methods and how to interpret results	**TI**
Application of knowledge to: • Determine the appropriate fault analysis method/s**,** to use through critical thinking and analysis of the options available • Plan and organise fault analysis operations in a logical and systematic manner for the work to be undertaken • Conduct fault analysis operations, taking ownership of the work and solving problems as they arise in the project • Interpret the results of fault analysis operations to identify and implement solutions to resolve engineering problems **Fault analysis methods** such as pre inspection, visual inspection, physical examination using approved tools/equipment, testing procedures to determine condition of equipment/plant	
TK4 How high voltage power generation, transmission and distribution plant & equipment operates	**TI**
Application of knowledge to: • Plan and organise work projects, using knowledge of the relevant plant and apparatus requirements	

Knowledge: Amplification and Guidance	EPA
• Conduct protection and commissioning operations on relevant plant and equipment during work projects	
TK5 Understands protection, control and telemetry equipment and the impact on the electrical network of its operation	**KA, TI**
Including: • The purpose and methods of the equipment used for unit protection on the network, including knowledge of typical protection schemes, types of relay and their settings, protection zones and the positioning / arrangement of equipment used in the circuit • The purpose and principles of earthing power network systems including the terminology used and the causes and effects of poor / inadequate earthing of systems • The purpose and principles of voltage transformers (VT) and current transformers (CT) in relation to the operation of power circuits, including knowledge of the different uses of CT's and VT's and their characteristics • The function and benefits offered by the remote control of network apparatus via telemetry including the type of systems and equipment used and the advantages and disadvantages • The role of a Commissioning and Protection Engineer working on network protection equipment including their technical duties and responsibilities Application of knowledge, during protection / commissioning projects, to: • Support the planning of work on protection / control / telemetry systems • Influence work decisions and support work conducted on protection / control / telemetry systems	
TK6 Commissioning and testing procedures & processes on high voltage apparatus	**TI**
Application of knowledge to: • Plan and organise commissioning and testing procedures on plant and equipment • Influence and support work decisions made during commissioning and testing operations on plant and equipment	

Knowledge: Amplification and Guidance	EPA
• Identify and resolve technical problems during commissioning and testing operations **Testing procedures** such as ROEP, CB timing test, use of equipment such as CT analysers	
TK7 Failure mode(s) of plant and equipment, their impact on the electrical network and the required remedial actions	**TI**
Application of knowledge to: • Recognise the symptoms and causes of relevant plant / equipment failure, such as RCD burnout, during work conducted on the network • Assess potential impact on the wider network of plant, of equipment failure • Support the analysis for decisions made to undertake remedial work on relevant plant and equipment following failure • Support remedial testing / work conducted on the network	
TK8 Understands high voltage electrical network operations and topologies	**KA**
Including: • The critical factors to take into consideration when commissioning substation Current Transformers (CT''s) and the purpose and method of conducting Primary Injection tests • The typical method and sequence of operations for an auto recloser detecting a fault on the network and the actions should a circuit breaker fail to clear a fault successfully • How substations are controlled remotely using a networked system, identifying the function and benefits offered by telemetry including the type of systems and equipment used • The typical power transformer vector groupings found on power networks and how to identify the different vector groups • The typical operational process undertaken for the safe isolation of a piece of network apparatus, identifying the symbols used to identify apparatus on the network and the responsibilities of persons involved	

Knowledge: Amplification and Guidance	EPA
• The typical tests and checks which should be carried out on a primary substation feeder circuit breaker with overcurrent and earth fault protection to ensure correct operation and the reason for each	
TK9 High voltage safe systems of work and risk management	**x**
Application of knowledge to: • Plan and carry out safe systems of work and risk management procedures relevant to their work projects • Enable recognition of the range of roles and responsibilities of persons involved in implementing and maintaining safe systems of work • Identify and manage risks relevant to their work during projects conducted on the network Safe systems of work such as toolbox talks, checklists, safeguarding equipment, Safety Rules, RAMS, putting people to work & RAMS, Work at height, COSHH, RIDDOR	
TK10 Understands the application of Electricity Supply Standards, regulations and policies	**KA, TI**
Including: • Recognise and implement the requirements of the Electricity at Work Regulations 1989 and the Electricity Safety, Quality and Continuity Regulations 2002 during work projects, identifying the differing responsibilities of persons involved • Recognise the effect and influence the power industry regulator Ofgem has on the planning and operational activities conducted during work projects on the network. Identifying the methods used by the regulator to control price increases and maintain standards • Support the process of the issue, receipt and / or cancellation of a safety document and identification of the responsibilities of the persons involved in the process	

Knowledge: Amplification and Guidance	EPA
TK11 The type and application of test equipment used for commissioning purposes	**TI**
Application of knowledge to: • Plan the use of test equipment and procedures required for protection and / or commissioning work • Conduct relevant test procedures in a logical and methodical manner on plant and / or apparatus for protection and / or commissioning work • Correctly interpret and record in a clear and concise manner test results which have been gained during the testing conducted **Test equipment** such as multimeters, test sets, analysers	

Skills: Amplification and Guidance	EPA
S1 Applies appropriate engineering and analytical processes to both normal and abnormal conditions on high voltage power generation, transmission or distribution plant & equipment	**TI, PO**
Application of knowledge on: • Relevant company engineering processes such as maintenance tests, commissioning procedures	
S2 Demonstrate application of safe working practices in line with company processes and legislative requirements	**TI, PO**
Application of knowledge to: • Relevant company safe working practices, processes, and legislative requirements, such as isolations, NSIs. risk assessment, managing hazards, manual handling, working at height, use of PPE, method statements	
S3 Use of a wide range of test equipment to confirm the suitability of the high voltage plant for conformity and operational service	**TI, PO**
Application of knowledge to: • Use different types of test equipment, for calibration and testing procedures e.g. voltage, polarity, earth loop impedance, to confirm the suitability and conformity of high voltage plant / equipment for operational service • Apply testing procedures and processes in a planned and methodical manner • Correctly interpret the test results • Use test information to make informed decisions and solve problems by using a logical and systematic approach	
S4 Accurately read and interpret a wide range of engineering diagrams and drawings	**TI, PO**

Skills: Amplification and Guidance	EPA
Application of knowledge covering: • A core knowledge of the range and specific use / purpose of a range of **engineering diagrams and drawings** such as tripping diagrams, circuit diagrams, wiring diagrams, layout diagrams, single line diagram, AC & DC schematic diagrams • Ability to use technical engineering diagrams and drawings to plan and organise the work activity	
S5 Prepares and checks technical reports	**TI**
Application of knowledge covering: • A detailed knowledge of the Company reporting methods and processes • The ability to produce and check technical reports in a methodical manner to record and inform the business of work projects • The ability to present technical information from reports in a clear and effective manner to sufficient depth for the audience • A clear understanding of the company process for reporting, amending incorrect and inaccurate technical information when identified	
S6 Effectively communicate with others to confirm that the tests meet the required standards/specifications	**TI, PO**
Application of knowledge covering: • Ability to identify the relevant internal / external stakeholders and the information they need to be given for confirmation of the testing • Ability to communicate both verbal and written information ensuring that all relevant parties understand the information given • Ability to present all information to others in a clear and concise manner and listen and respond to queries / questions • Ability to ensure that recipient/s understand any critical safety / technical information and confirm their understanding where necessary	

Specific Skills: Amplification and Guidance	EPA
Plant Skills	
PL1 Undertake testing, commissioning and maintenance activities on electrical power systems and equipment. This could include transformers, switchgear, conductors, battery systems and ancillary equipment	**TI, PO**
PL1 forms the subject title of a main topic area for discussion in the interview. • A core knowledge of the company testing, commissioning and maintenance procedures relevant to the electrical systems / equipment relevant to their work activity • A clear plan of action to undertake the work operations in a logical manner which considers the resources required for the work • The ability to competently follow the appropriate policy / procedure and implement the work plan to achieve their objectives • The ability to competently deliver the work objectives to meet the agreed deadlines / timescales • The ability to recognise and define potential problems and identifies and solve them in a step by step logical way, where necessary • The ability to take ownership and personal responsibility for the work of themselves and others under their control during the work activity	
Protection Skills	
PR1 Undertake protection, testing, commissioning and maintenance activities involving functionality testing and the injection of currents and voltages into high voltage equipment and their associated protection and control systems to simulate the range of fault conditions and scenarios that can occur on the electrical system	**TI, PO**

Specific Skills: Amplification and Guidance	EPA
Plant Skills	
PR1 forms the subject title of a main topic area for discussion in the interview. • A core knowledge and understanding of the method and purpose of injection testing on the high voltage equipment • A clear plan of action to undertake testing operations in a logical manner which considers the resources required for the testing operations • The ability to inspect and use the test / injection equipment in accordance with the Company polices / manufacturer's instructions • The ability to identify and apply testing / injection procedures in a methodical manner as appropriate to the situation • The ability to gather and interpret the test / injection results gained to meet the objectives of the testing operation • The ability to record / report the test / injection results gained to meet Company requirements / standards	
PR2 Use appropriate test equipment to verify protection and control settings and ensure correct installation and operation of modern microprocessor and numerical based protection as well as older electromechanical relays	**TI, PO**
PR2 forms the subject title of a main topic area for discussion in the interview. • A core knowledge of the purpose and operation of microprocessor / numerical based protection • A core knowledge of the relevant test procedures and control settings used to verify the correct operation of the protection equipment being worked on • The ability to choose and follow the correct methods / procedures to carry out the installation / testing of protection equipment • The ability to apply the correct methods / procedures to verify the correct control settings / operation of the protection equipment in a methodical manner	

Specific Skills: Amplification and Guidance	EPA
Plant Skills	
• The ability to correctly gather and interpret test results obtained to inform actions taken for the protection system being worked on • The ability to communicate progress to others by recording / reporting the outcome of their installation / testing operations in accordance with Company policies and procedures	
PR3 Ensure that protection systems interface correctly with the associated high voltage equipment and, where necessary, coordinates effectively with the wider high voltage system	**TI, PO**
PR3 forms the subject title of a main topic area for discussion in the interview. • A core knowledge of how the protection system being worked on interfaces with the associated high voltage equipment and the wider network • A core knowledge of the relevant test procedures and equipment used to verify the correct interface of the protection equipment with the system • The ability to choose and follow the correct methods and procedures to practically achieve the testing / verification of the protection system being worked on • The ability to methodically apply the correct methods and procedures to verify the correct interface of the protection system being worked on • The ability to recognise and tackle technical issues in a step by step logical and methodical way and achieve an effective resolution • Their ability to communicate progress to others by recording / reporting the outcome of their protection operations in accordance with Company policies and procedures	