POWER

Governance of Network Design Competence

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Executive Summary

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Background

Over recent years the design of power networks has moved from only being undertaken by the Network Owner to a point where it is undertaken by numerous businesses either as Asset Owners or as National Electricity Registration Scheme (NERS) providers.

Power network designers were historically trained by the Asset Owner to their own standards. While this process of training for staff is not diminished by this new framework, the new framework is perceived necessary because of the diversification of the industry. This new framework provides guidance to requirements and development pathways to meet the industry's challenges.

This framework seeks to set the benchmarks for the whole industry and ensure staff have the appropriate knowledge, skills, and experience in order that a Network Owner, Provider, and other organisations can design networks that are safe, economic, and technically correct and meet all of their obligations.

Industry for Industry

The Governance of Network Design Competence has been developed by Network Owners, Independent Connection Providers in conjunction with Lloyds Register, National Skills Academy for Power, training providers and recognised institutions.

National Electricity Registration System (NERS)

The Governance of Network Design Competence has been developed in conjunction with Lloyds Register to ensure the training modules deliver the required skills, knowledge, safety and experience required to meet the NERS scheme expectations for Designers over time.

The Governance of Network Design Competence and the NERS guidance document have been aligned to make determining competency at the different voltage levels consistent.

Competition in Connection Code of Practice

This CiC Code of Practice sets out the processes and practices that DNOs will follow to facilitate competition in the provision of connections to their distribution systems by third-party connection providers through competition. In so doing the CiC Code of Practice sets out a number of principles that the Governance of Network Design Competence seeks to meet and this includes:

- Knowledge of health, safety and the environment;
- Minimising, to the fullest extent reasonably practicable, the number and scope of input services which are only available from the DNO;
- Providing input services on an equivalent basis to all connection parties that operate in the Local Connections Markets; and
- Harmonising, to the fullest extent reasonably practicable, the input services provided by Distribution Service Providers.

Training

The Governance of Network Design Competence recognised that Network Owners and Independent Connection Providers train their staff proportionately to their business needs. It enables such training to be structured and consistent in a modular format that recognises achievement without adding any further burden on the business.

The modules are formatted to enable a new starter or an experienced person changing or enhancing their skills to gain the necessary skills, experience and knowledge to design networks that are safe at all points during their life cycle, technically correct and cost efficient.

The modules build from a core, through various voltages and network types, in a progression of steps and are relevant to the duties of the designer. The modules do not seek to replace nationally recognised academic qualifications or college courses but seeks to support these through the structured approach.

Aspirational
Governance of Network Design Competence provides a clear development process for staff through a series of modules, so encouraging staff to gain new and relevant skills and knowledge in a structured way. This provides staff with an aspiration goal which is cost effective to the business and that is proportionate to it.

Grandfather Rights
The Governance of Network Design Competence also recognises that many existing staff have built up experience over many years in designing networks and have existing academic qualifications. Such experience and knowledge can be mapped against the modules to meet the expectations of Network Design Competence. It also acknowledges that as staff progress they will need additional training and that should be aligned with the principles set out in the document.

Client Reassurance
As part of a client's due-diligence when appointing an Independent Connection Provider they may seek to assure themselves that the ICP can design networks that are fit for purpose and compliant with all relevant standards. Adoption of the Governance of Network Design Competence demonstrates a commitment to well trained staff that have all the necessary capabilities to meet a clients' need.

NERS
Independent Connection Providers that adopt the principles and processes set out in Governance of Network Design Competence will be meeting the requirements of a NERS Audit for Design capability and therefore the competence of individuals and Company Compliance can be assumed in respect of training, skills and knowledge.

NERS – NERSAP
The Governance of Network Design is recognised by the NERSAP Governance Group on behalf of the NERS Process as being the benchmark standard therefore meeting the expectations of the NERS Guidance document in respect of training and the competence of design staff.

Implementation Timeline

NERS Forum Presentation	4th July 2017
NERSAP Final Review	18th July 2017
NERSAP Approval	21st November 2017
NERS Guidance Edition update	February 2018
Governance of Network Design	November 2018

SECTION 1. Issue, Review and Amendment

This document shall be made available through the National Skills Academy for Power (NSAP) website and through NERS assessment organisation.

Representatives of the original development group, will form a governance group and shall review the document at least once every two years to re-affirm it's conformity to the current requirements of company policy or other external changes or immediately if its contents are deemed to be no longer valid.

Where revisions are required they shall be made by replacement of the applicable page(s). An amended revision number and the date of revision shall identify each revised document; this shall be detailed within the document revision table below.

When changes affect a considerable number of pages, this document shall be re-issued/revised in its entirety, incorporating all previous revisions. A number shall identify issues and each issue shall cancel and replace all previous issues and revisions. Revisions shall be identified by a number and shall replace the previous revision.

Document Reviews		
Date	**Revision**	**Reviewer**
10/09/2015	Draft A	L Allsopp
29/09/2015	Working Group Draft B	L Allsopp
03/05/2016	Working Group Draft C	L Allsopp
22/06/2016	Working Group Draft D	L Allsopp
01/08/2016	Working Group Draft E	L Allsopp
12/06/2017	NERS Working Group amendments Drafts F	L Allsopp
28/02/2018	Substation Design up to 20kV	MT Bracey
07/10/19	Amendment of scheme registration section prior to website posting	S Richards

SECTION 2. Glossary

2.1. Abbreviations

Abbreviation	Meaning
CDM 2015	The Construction (Design and Management) Regulations 2015
DNO	Distribution Network Owner
ICP	Independent Connections Provider
IDNO	Independent Distribution Network Owner
IET	The Institution of Engineering and Technology
NERS	National Electricity Registration Scheme (Lloyds)
NSAP	National Skills Academy for Power
OFGEM	Regulates the electricity and gas markets in Great Britain
POC	Point of Connection
BNO	Building Network Operator
EHV	Extra High Voltage – voltages >20kV up to and including 132KV
HV	High Voltage - voltages >1kV and ≤20kV
LV	Low Voltage – voltages < 1kV

2.2 Meanings

Terminology	Meaning
Asset Owner	Organisations who own and operate electrical assets and infrastructure commonly known as DNO and IDNO
Distribution Service Providers	Organisation/Companies who undertake work on behalf of Distribution Network Owners/Operators
Independent Connection Providers	Companies who undertake contestable works associated with the installation of electrical connections
Distribution Network Owner	An Asset owner such as a DNO, IDNO or similar (excludes BNO and Private Network Operator)
Power Networks	All or any part of a system that distributes electricity
NERS Provider	Collective term for ICP's

2.3 Definition

Definition	Meaning
Assessing Officer – Design	A person appointed by the Provider to assess the competency of individuals nominated for appointment as a competent Designer and for recommending them for authorisation by the Authorising Officer
Awareness	A broad understanding of electrical and civil requirements that a person engaged in design needs to have which is relevant to their occupation and specific duties
Designers	Persons engaged on the design of electricity power networks who shall be able to provide evidence of competence incorporating the necessary knowledge, skills, training and experience of the design activity.
Shall	An absolute requirement of the scheme

SECTION 3. Competition in Connections Code of Practice

This code of practice sets out the processes and practices that DNOs will follow to facilitate competition in the provision of connections to DNOs' distribution systems by third-party connection providers. The following is a direct extract from the code of practice that is relevant to this document:

3.1. Relevant Objectives (Section 2.3)

The relevant objectives of this code of practice are to:

- Facilitate competition in the market for new electricity distribution connections through:
    - Knowledge of health, safety and the environment;
    - Minimising, to the fullest extent reasonably practicable, the number and scope of input services which are only available from the DNO;
    - Providing input services on an equivalent basis to all connection parties that operate in the Local Connections Markets; and
    - Harmonising, to the fullest extent reasonably practicable, the input services provided by Distribution Service Providers.
- Not distort, prevent or restrict competition in the market for new electricity distribution connections; and
- Facilitate compliance with the regulation and any relevant legally binding decisions of the European Commission and/or the Agency for the Co-operation of Energy Regulators.

SECTION 4. Scope

The scope of this framework is intended to cover the design of Power Networks up to and including 132kV. This includes all aspects of the design lifecycle from conception to project completion, including design variations.

This document incorporates all NERS design scopes as set out in the requirements document

4.1. In Scope

The following is considered in scope:

- Design of underground networks up to and including 132kV
- Design of overhead networks up to and including 132kV
- Design of substations up to and including 132kV
- Network Protection
- Network Earthing
- Network Safety and Integrity
- New and emerging technologies

4.2. Associated Scope Awareness

The following items need to be considered by the Designer during the design to ensure that suitable designs are produced in terms of viability or technical perimeters of a scheme. Individual companies will have processes and procedures to ensure compliance:

- Civil design and construction
- Deep or none standard excavation
- Legal acquisition and wayleaves
- Renewable design
- Private Networks (none licensed)
- Work to BS7671
- Meter Operators
- Building Network Owners

4.3. Out of Scope

The following design tasks are considered out of scope:

- Networks above 132kV

SECTION 5. Objectives

The objectives of this document are:

- To provide a competence standard for designers;
- To provide a pathway for consistent designer development;
- To ensure designs meet appropriate standards;
- To provide stakeholders with confidence in the designs produced;
- To support a future pathway for self-regulation;
- To help DNOs discharge their obligations under OFGEM Competition in Connections Code of Practice;
- To ensure stakeholders meet their obligations in accordance with NERS.
- To promote fair competition in the industry

SECTION 6. Responsibilities

The following have responsibilities in order to ensure that designs of electrical networks meet agreed current standards and that the customer has a safe and secure supply:

- Designer – to work towards, achieve and maintain the required level of competence agreed with his/her employer, in-line with the requirements of this document
- Employer – to use the requirements of this document to provide the training, guidance and support required for Designers to achieve and maintain the required level of competence
- NERS Audits – to provide support and guidance to employers during and between audits. To highlight changes required to this document, in-line with the main NERS documentation requirements, for consideration by the Governance Group
- Governance Group - to review this document and agree changes in-line with current agreed standards and requirements, including changes to the Competition in Connections Code of Practice
- Electricity Networks Association – to highlight changes to the Competition in Connections Code of Practice to the Governance Group to enable this document to be reviewed
- NERSAP – the final arbitrator in-terms of disputes in application or content of this Governance document

SECTION 7. Governance Process and Control

7.1. General

Designers will have access to all necessary information to enable them to produce designs to a consistent standard, incorporating statutory and regulatory obligations.

Design processes and procedures shall cover the complete lifecycle from engagement to the project completion.

7.2. Design Groups and Categories

7.2.1. NERS Design Scopes

The following are the individual design scopes as detailed in NERS:

- LV Underground Cable Networks
- LV Overhead Cable Networks
- HV Underground Cable Networks up to and including 20kV
- HV Overhead Cable Networks up to and including 20kV
- HV Underground Cable Networks above 20kV up to and including 132kV
- HV Overhead Cable Networks above 20kV up to and including 132kV
- Substation layouts up to and including 20kV
- Substation layouts above 20kV up to and including 132kV
- Self-determination of Point of Connection (POC) LV
- Self-determination of Point of Connection (POC) up to and including 20kV
- Self-determination of Point of Connection (POC) above 20kV up to and including 132kV

7.3. NERS Designer Standards

The following industry agreed designer standards have been developed to facilitate an effective modular approach to designer competence whilst maintaining correlation with NERS scopes:

- Core Skills and knowledge;
- Low Voltage;
- High Voltage; and
- Extra High Voltage.

7.4. Designer Specifications

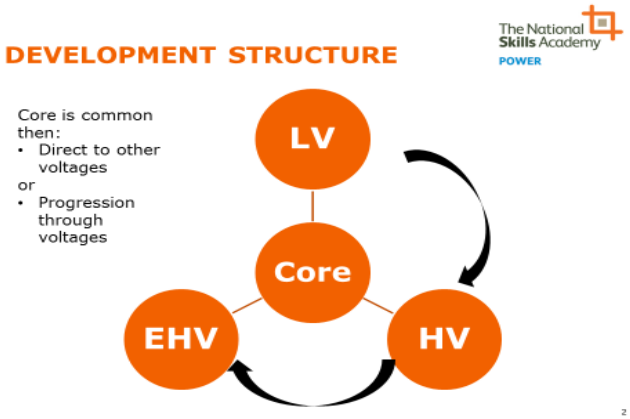
The designer standards are further broken down in to specifications which have been developed from a broad spectrum of industry good practice to ensure designers consistently have the necessary skills, technical knowledge and academic requirements to deliver designs to the agreed requirements.

- **Core Design Skills:**
  - Principles of Health and Safety for Design
  - Fundamental Principles of Electric Network Design
  - Principals of Installing an Electric Network
- **Low Voltage:**
  - LV Overhead Network Design
  - LV Underground Network Design and
  - Embedded Generation and other new Technologies
- **High Voltage:**
  - HV Underground Cable Network Design at Voltages up to and including 20kV;
  - HV Overhead Line Network Design at Voltages up to and including 20kV; and
  - HV Substations Design at Voltages up to and including 20kV.
- **Extra High Voltage:**
  - EHV Substation layouts for a Safe Working Environment (above 20kV to132kV)
  - EHV Design - Switchgear and Capabilities (above 20kV to132kV)
  - EHV Substation Earthing System Design (above 20kV to132kV)
  - EHV Design Vector Groups (above 20kV to132kV)
  - EHV Protection systems (current, unit, distance, earth fault, etc.) (above 20kV to132kV)
  - EHV Cable Networks above 20 up to 132 kV; and
  - EHV Overhead Networks above 20kV up to 132 kV.

These specifications are attached in appendix A.

7.5. Designer Development Structure

In order that new designers can build their skills and experience in a logical manner, all new designers will need to demonstrate competence in the core standards. These are seen as the foundation skills and knowledge and support all other standards. Progression, subject to employer requirements, can be progressive e.g. Core to LV to HV to EHV or directly to the required next group e.g. Core to HV.



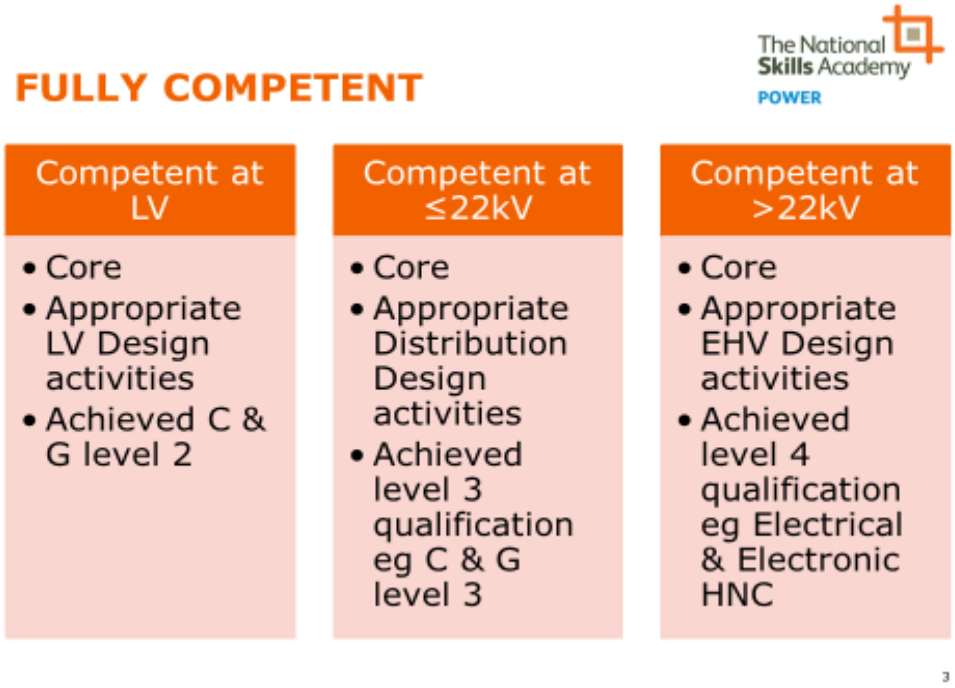
7.6. Minimum Academic Standards

The following sets out the **minimum** standards that designers are required to achieve to have adequate technical knowledge:

- Core - GCSE grade C or above (or equivalent) in maths & English or equivalent experience;
- LV - City & Guild 2339 Certificate in Electrical Technology Engineering level 2 or equivalent;
- HV - ONC in Electrical & Electronic Engineering or equivalent level 3 qualification;
- EHV - HNC in Electrical & Electronic Engineering or equivalent level 4 qualification.

7.7. Progression

Designers can commence learning and gathering evidence to progress to the next group subject to employer agreement. During this period they must commence the appropriate academic study required for the next group. They will however not be judged as competent until they meet all requirements for the next group, including academic – see below



SECTION 8. Grandfather Rights and Annual Reviews

8.1. Grandfather Rights

Existing designers operating on implementation of this new competence structure will continue as now. However if, subject to employer approval, they are required to undertake different designs in the same group e.g. LV Underground to LV Overhead or undertake designs in a different groups e.g. LV to HV, they will be required to meet all requirements of the new group or standard, including academic.

Existing designers, on implementation of the processes described in this document, will be considered as competent to undertake exactly the same type of designs as they do now. Existing competence will need to be agreed against the specifications in appendix A eg LV Underground

It is not proposed to place a time limit on Grandfather Rights but as staff develop their skills and extend their competence the scheme will be applied

8.2. Annual Reviews

In line with good Company Practice staff competencies will be reviewed annually. The Annually Review shall be conducted in line with is document and any development needs identified will be delivered in accordance with his documents.

As part of an Annual Review an assessment of scheme will ensure that all designers meet the appropriate requirements of the Competition in Connections Code of Practice, Part B Section 4.0 The Connections' Process.

SECTION 9.0 Assessment Process

9.1. Assessment

In supporting NERS accreditation the designer standards shall be considered as the minimum evidence required to agree designer competency. Each specification details the types of evidence required. Design work shall only be carried out by Designers assessed as competent for the particular work required

The assessment process will ensure that all designers meet the appropriate requirements of the Competition in Connections Code of Practice, Part B Section 4.0 The Connections' Process.

9.2. Assessing Officer – Design

Assessment and Authorising Officers appointed by the companies can undertake the assessments of designers in their organisations. They would need to demonstrate, as part of the NERS process, that they are competent in the area that they are assessing.

SECTION 10.0 Possible Registration Scheme

An Energy & Utility Skills Registration Scheme is an aspiration of the standards development work and has not been an active part of this project.

Such a registration scheme, if it were to be developed, would not be compulsory, but, rather, would be seen as good practice. It would allow Employers to record and view individuals' competence eg LV Underground, and would, therefore, facilitate the movement of individuals within the industry.

To support any possible development of such a Scheme, the following basic specification is agreed:

- Scope – covers all design categories
- Criteria to register – working towards any design specification contained in appendix A
- Information about the individual Designer
- Photos on the certificate is required
- Grandfather rights – see section 9
- Routes to competence – individuals will be assessed as competent by the Authorising and Assessment Officer
- Re-assessment periods and process – re-assessment is formally undertaken every 3 years. The process would be undertaken by the Authorising and Assessment Officer. The requirements of the specifications (appendix A) would be used as the basis to confirm the re-assessment outcome

A Registration Scheme would provide a quick and easy way to see an individual's design competence profile making NERS reviews more efficient as well as providing ease of access for companies when people move, for example, and supports the desire for standards consistency.

SECTION 11.0 Customer Confidence

The Competition in Connections Code of Practice states that DNOs are committed to putting arrangements in place that facilitate effective and efficient competition in the market for the provision of connections. Such arrangements will help improve the quality of service that customers receive.

The designer standards referred to in this document, consistently applied, shall ensure designers are meeting their businesses customer service obligations in providing honest, accurate designs or information at minimum cost and that can be delivered in a timely manner. This will provide customers with a consistently high standard of service throughout the design cycle and subsequent construction delivery.

SECTION 12.0 Review

NSAP, Network Owners, Independent Connection Providers, Lloyds assessment organisation and other associated organisations shall from time to time review this and associated documents.

SECTION 13.0 Equality and Audit Process

As part of a self-regulation process in fulfilling the spirit of equality of process for the OFGEM Code of Practice for Connections, the Governance Group shall from time to time undertake a review of businesses fulfilling the obligations of this process and it standards.

NERS audit processes of ICPs shall take into account the guidance in this and the associated documents to ensure designers meet these minimum standards.

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Section A - Electrical Power Network Design Competency Specifications

Module 1 - Core Design Skills - Principles of Health, Safety and Environment
Module 2 - Core Design Skills - Fundamental Principles of Power Network Design
Module 3 - Core Design Skills – Principles of Installing and Operating an Electrical Network
Module 4 - LV Network Design - Underground Networks
Module 5 - LV Network Design - Overhead Line Networks
Module 6 - LV Network Design - Incorporating Embedded Generation & Other New and Emerging Technologies
Module 7 - HV Network Design - Underground Networks (up to 20kV)
Module 8 - HV Network Design – Overhead Line Networks (up to 20kV)
Module 9 - HV Network Design – Substations (up to 20kV)
Module 10 – EHV Design Skills
Module 11 – EHV Network Design (above 20kV to 132kV)
Module 12 – EHV Design Skills - Substation Earthing System Design (above 20kV to 132kV)
Module 13 – EHV Design Skills - Vector Groups (above 20kV to132kV)
Module 14 – EHV Design Skills - EHV Protection Systems (current (IDMT), unit, distance, earth fault) (above 20kV to 132kV)
Module 15 – EHV Design Skills - EHV Cable System (above 20kV to 132kV
Module 16 – EHV Design Skills - EHV Overhead Line System (above 20kV to 132kV)

Module 1 - Core Design Skills - Principles of Health, Safety and Environment

This training specification details the required knowledge to provide learners with an understanding of the core principles of health, safety and the environment and their application to the design of power networks. In addition it provides the knowledge required to allow a designer to operate safely on site in a power network environment.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to identify and comply with the relevant health, safety and environmental legislation, regulations and responsibilities to allow design work to be conducted safely in power network environments.
- Being able to describe the principles of health, safety and environment and how they affect and influence the design of power networks.
- Being able to carry out a risk assessment in a power network environment, identifying typical hazards and describing the measures required to control or avoid those hazards.
- Being able to conduct a site survey to identify relevant health, safety and environmental factors, constraints and customer requirements which may influence the electrical design to be produced.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Maths / English (GCSEs grade C or above) or an equivalent qualification / experience
- Completed a Company induction / safety briefing
- Completed role specific training on personal responsibilities

How will this module be assessed?

This module should be assessed through the use of work based evidence gathered by the candidate and submitted to a nominated Company manager / design engineer who has suitable and sufficient knowledge and / or experience of the health, safety and the environmental principals involved in the design of electrical power networks in the UK.

Performance Criteria

To achieve this unit, you will need to be able to:

P1 Select, inspect and wear required personal protective equipment in line with statutory requirements and Company procedures.

P2 Carry out a site specific risk assessment of power network environments, identifying any hazards on site and how to control those hazards.

P3 Carry out a site survey in a power network environment to identify factors, constraints, customer requirements which may influence the electrical design to be produced.

P4 Produce and record site survey information to allow the electrical design to be produced.

P5 Comply with relevant Company site safety policies, procedures and regulations and leave the site in a safe condition.

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The relevant legislation applicable to the design of power networks, including –

- Health and Safety at Work Act 1974
- Electricity at Work Act 1989
- Electricity Act 1989
- Environmental Protection Act 1990

K2. The relevant regulations applicable to the design of power networks, including -

- Management of Health and Safety at Work Regulations
- Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002.
- Construction Design and Management (CDM) Regulations 2015.
- Control of Substances Hazardous to Health (COSHH)
- Working at Height
- Manual Handling
- Working in Confined spaces
- Wiring regulations (BS7671)
- Asbestos
- PPE

K3. The relevant Company Distribution Safety Rules, policies and procedures which can affect the work of a design engineer.

K4 The process and purpose of carrying out a site specific risk assessment and the type of hazards present on a power network site.

K5. The definition of hazard and risk and be able to describe the difference between them.

K6. The methods used to control risk including the use of risk control hierarchy e.g. ERICPD

K7. The specific CDM responsibilities which apply to power network designers.

K8. How to plan and carry out a site survey to identify and record the factors needed to produce a site survey report.

K9. How to enter, exit and work in a power network site environment safely and leave a site in a safe condition.

Module 2 - Core Design Skills - Fundamental Principles of Power Network Design

This training specification details the required knowledge elements to provide learners with an understanding of the fundamental principles of power network design in the UK and the factors which affect and influence the design of power networks in the UK.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to describe the principles and methods of power generation, transmission and distribution from its source to the customer's point of connection.
- Being able to identify the purpose and fundamental design characteristics of the differing types of electrical plant and apparatus used in the design of electrical power networks.
- Being able to describe the engineering and environmental factors which affect and influence the design of overhead and underground electrical power networks.
- Being able to describe the hazards which specifically affect the design of electrical power networks and the design methods used to control them.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Maths / English (GCSEs grade C or above) or an equivalent qualification / experience
- Completed a Company induction / safety briefing
- Completed role specific training on personal responsibilities

How will this module be assessed?

This module will be assessed through the use of work based evidence gathered by the candidate and submitted to a nominated Company manager / design engineer who has suitable and sufficient knowledge and / or experience of the principals involved in the design of electrical power networks in the UK.

Knowledge and Understanding

To achieve this unit, you will need to know and understand how to:

K1 Identify and describe the fundamental principles of power network design including the methods used for electrical:–

a) Generation
b) Transmission
c) Overhead and underground distribution to the customer's point of connection.

K2 Identify the purpose and fundamental design characteristics of the differing types of electrical plant and apparatus used in the design of electrical power networks, including:–
a) Transformers
b) Circuit breakers
c) HV and LV fuses
d) HV and LV Switchgear

K3 Describe the engineering and environmental factors which affect and influence the design of overhead and underground electrical power networks.

K4 Identify the common types and design characteristics of underground cable and overhead line conductor types used in the design of UK power networks.

K5 Describe the principles and types of protection systems used in the design of UK power networks.

K6 Describe the principles and application of electrical earthing systems used in the design of UK power networks.

K7 Identify the impacts of disturbing loads on an electric network, including the effects of harmonics.

K8 Analyse and interpret technical documents and standards which apply to the design of electrical power networks including asset owner design standards.

K9 Carry out basic power calculations using formulae commonly used in the design of electrical circuits, including the basic calculations used for voltage, current, resistance and power.

K10 Identify the types of load on domestic and non-domestic networks and use basic formulae to calculate loads.

K11 Identify the differences between AC and DC systems and their benefits and limitations.

K12 Describe the impact of power factor on network load (apparent power).

K13 Describe how electrical networks can be diversified and the benefits of diversification.

K14 Identify the UK statutory limits on voltage supplies and the voltage tiers which apply.

K15 Identify the cable ratings of differing cable types and sizes and how they can reduce a networks capacity.

K16 Identify the design factors which can be applied to take into consideration the future loading of a power network in relation to network growth.

K17 Identify the standard excavation depths of underground cables used in the UK and the identification and protection methods used for underground cables..

K18 Describe the basic principles of how electrical power networks can be remotely monitored / controlled and the benefits of using this type of technology.

K19 Identify and describe the basic principles of smart grid systems and their influence on power network design.

K20 Describe the basic purpose and principles of smart metering including the benefits it can provide and the supplier's responsibilities.

K21 Describe how poor network design can affect the risks on health, safety and environment during installation / construction activities, including the factors of deep excavation and cramped / confined spaces)

Module 3 - Core Design Skills – Principles of Installing and Operating an Electrical Network

This training specification details the required knowledge elements to provide learners with an understanding of the principles of installing and operating an electrical network in the UK and the factors which affect and influence the design of the network.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to describe the impact an electric network can have on built environment
- Being able to identify the factors that can impact on an electric network

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Maths / English (GCSEs grade C or above) or an equivalent qualification / experience
- Completed a Company induction / safety briefing
- Completed role specific training on personal responsibilities
- Completed module 2 Fundamental Principles of Electric Network Design

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification.

The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies

- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

To achieve this unit you must be able to:

P1 demonstrate how the installation of an electric network can impact an existing site

P2 describe how design decisions can impact on construction and operation of an electric network including complexity of task undertaken and Health &Safety risks.

P3 identify environmental risks associated with network installation.

Knowledge and Understanding

To achieve this unit, you will need to know and understand:

K1 The impact of the following legislation or guidelines relevant to installing / operating an electric network, and be able to identify which aspects of a design they apply to:-

- New Roads and Street Works Act (NRSWA) 1991.
- Construction (Design and Management) (CDM) 2015.
- Electricity at Work Act 1989
- Electricity Safety, Quality and Continuity Regulations (ESQCR) 2002.
- Street Works UK / Highway Authorities and Utilities Committee (HAUC) guidelines.
- ISO 55000 – standards for asset management.
- HSE - HSG 47 (Avoiding danger from underground services)
- HSE - GS 6 (Avoiding danger from overhead power lines)

K2 The impact on designs of hazardous construction / operational environments including:

- Confined spaces
- Deep excavations
- AME (Access, movement, egress)
- Contaminated land
- Proximity of other utilities.
- Site Location.

K3 The range of mitigation methods that could be required to reduce the risk of working in the areas listed above.

K4 How the security risk of a site can be assessed and reduced at a design stage.

K5 How the environmental risk of a site can be assessed and reduced at a design stage.

K6 The impact of the requirements of a network operator on restoration of supplies from ESQCR and P2/6.

K7 The impact of the requirement for line watch (for overhead line networks)

K8 The importance of retaining as-laid information.

K9 The requirement for asset owners to maintain equipment over its life cycle.

K10 The rights of a statutory undertaker, and process for installation in adopted land (Notices under NRSWA).

K11 The need for wayleaves/easement requirements for installation in private land.

K12 The cost aspect of a design undertaken, and awareness that a different design could result in different costs at an installation stage and through the life cycle of the design.

Module 4 - LV Network Design - Underground Networks

This training specification details the skills and knowledge required to carry out the design of low voltage distribution underground networks in the UK.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete low voltage underground design schemes taking into account relevant legislation, regulatory requirements, network specifications and load requirements.
- Being able to demonstrate a detailed knowledge of the principles of network operating theory design.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core units
- Completed, as a minimum, a relevant C&G Level 2 vocational award or its equivalent

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification.

The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies
- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

General Requirements

To achieve this unit, you will need to be able to:

P1 Identify the correct specifications and limiting parameters to be used for each design being completed

P2 Interpret client/asset adopter requirements to enable designs to be completed

P3 Interpret customer requirements to enable designs to be completed

P4 Produce designs which incorporate company commercial requirements and risk strategies

P5 Produce design packs for submission which include calculations, drawings and engineering reports.

Task Specific Requirements

P6 Identify the underground networks point of connection (POC) and its parameters from available information / matrix

P7 Identify the specific materials to be used for the underground networks design based on network owner requirements

P8 Produce an outline design of the underground network with the POC parameters, specifications and materials included

P9 Carry out volt drop and earth loop impedance (ELI) calculations of the underground network to support designs

P10 Finalise the underground network design requirements, including formal design detail and engineering reports suitable for final submission

P11 Produce full Construction Design & Management (CDM) packs and their associated documents suitable for handover of the designed underground network to the construction team

Knowledge and Understanding

General Requirements

To achieve this module, you will need to know and understand:

K1. The principles of LV network design as identified in Asset Owners G81 documents

K2. The principles of LV earthing systems (4124)

K3. The purpose and principles of LV protection systems including the selection and use of fuses and relays and how to carry out basic fault calculations

K4. The calculation of after diversity maximum demand (ADMDs) and the reasons that differences occur

K5. The design and interface requirements between DNO and IDNOs as detailed in G88

K6. The operational requirements and principles applicable to work on LV networks

K7. The requirements for unmetered and metered supply connections in relation to MPRN's and meters

K8. The effect on LV networks system performance and harmonics and disturbing loads

K9. The selection and use of appropriate equipment and materials as detailed in the Asset Owner G81

K10. The implications of downstream embedded generation and the implications of the interface with other systems

K11. The design requirements for multiple occupancy buildings as detailed in G87 and relevant British Standards

Task Specific Requirements

K12. The cable types and jointing principles applicable to LV underground networks

K13. The purpose and function of earthing systems relevant to LV underground designs

K14. The purpose and function of Protection systems relevant to LV underground designs

K15. LV underground network design principles and parameters as identified in the Asset Owner G81 documents

K16. How to determine design principles and parameters for metered and unmetered LV underground network supplies

K17. How to determine the network design requirements of single phase LV underground network domestic connections including the metering implications

K18. How to determine the network design requirements of three phase LV underground network industrial/commercial connections including the metering implications

Module 5 - LV Network Design - Overhead Line Networks

This training specification details the skills and knowledge required to carry out the design of low voltage distribution overhead line networks in the UK.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete low voltage overhead line design schemes taking into account relevant legislation, regulatory requirements, network specifications and load requirements.
- Being able to demonstrate a detailed knowledge of the principles of network operating theory design.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core units
- Completed, as a minimum, a relevant C&G Level 2 vocational award or its equivalent
- Completed Module 4 LV Network Design - Underground Networks

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification.

The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies
- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

General Requirements

To achieve this unit, you will need to be able to:

P1 Identify the correct specifications and limiting parameters to be used for each design being completed

P2 Interpret client/asset adopter requirements to enable designs to be completed

P3 Interpret customer requirements to enable designs to be completed

P4 Produce designs which incorporate company commercial requirements and risk strategies

P5 Produce design packs for submission which includes calculations, drawings and engineering reports.

Task Specific Requirements

P6 Identify the overhead networks point of connection (POC) and its parameters from available information / matrix

P7 Identify the specific materials to be used for the overhead networks design based on network owner requirements

P8 Produce an outline design of the overhead network with the POC parameters, specifications and materials included

P9 Carry out volt drop and earth loop impedance (ELI) calculations of the overhead network to support designs

P10 Finalise the overhead network design requirements, including formal design detail and engineering reports suitable for final submission

P11 Produce full Construction Design & Management (CDM) packs and their associated documents suitable for handover of the designed overhead network to the construction team

Knowledge and Understanding

General Requirements

To achieve this module, you will need to know and understand:

K1. The principles of LV network design as identified in Asset Owners G81 documents

K2. The principles of LV earthing systems (4124)

K3. The purpose and principles of LV protection systems including the selection and use of fuses and relays and how to carry out basic fault calculations

K4. The calculation of after diversity maximum demand (ADMDs) and the reasons that differences occur

K5. The design and interface requirements between DNO and IDNOs as detailed in G88

K6. The operational requirements and principles applicable to work on LV networks

K7. The requirements for unmetered and metered supply connections in relation to MPRN's and meters

K8. The effect on LV networks system performance and harmonics and disturbing loads

K9. The selection and use of appropriate equipment and materials as detailed in the Asset Owner G81

K10. The implications of downstream embedded generation and the implications of the interface with other systems

K11. The design requirements for multiple occupancy buildings as detailed in G87 and relevant British Standards

Task Specific Requirements

K12. The conductor types and construction principles applicable to LV overhead networks

K13. The purpose and function of earthing systems relevant to LV overhead designs

K14. The purpose and function of Protection systems relevant to LV overhead designs

K15. LV overhead network design principles and parameters as identified in the Asset Owner G81 documents

K16. How to determine design principles and parameters for metered and unmetered LV overhead line supplies

K17. How to determine the network design requirements of single phase LV overhead line domestic connections including the metering implications

K18. How to determine the network design requirements of three phase LV overhead line industrial/commercial connections including the metering implications

Module 6 - LV Network Design - Incorporating Embedded Generation & Other New and Emerging Technologies

This training specification details the skills and knowledge required to carry out the design of low voltage distribution networks, incorporating embedded generation and other new and emerging technologies, in the UK.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Bing able to complete low voltage designs using knowledge and principles of embedded generation and other new and emerging technologies
- Understanding and demonstrating the effect on network designs and operating theories of embedded generation and other new and emerging technologies

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core units
- Completed, as a minimum, a relevant C&G Level 2 vocational award or its equivalent
- Completed Module 4 LV Network Design Underground Networks

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification.

The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies

- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

General Requirements

To achieve this unit, you will need to be able to:

P1 Identify the correct specifications and limiting parameters to be used for individual network designs by utilising manufacturer and other data sources

P2 Interpret client/asset adopter requirements, to enable the design to be completed

P3 Interpret customer requirements to enable designs to be completed

P4 Consideration of embedded generation and other technologies, their impact on network designs and active network management strategies

P5 Consideration to company commercial and risk strategies

P6 Produce a design pack for submission including assumptions, data sources, calculations, drawings, engineering reports etc

Task Specific Requirements

P7 Determine the POC, or identify POC parameters from available information or matrices where provided

P8 Identify network constraints in relation to the power quality of the existing network, such as harmonics, frequency etc

P9 Evaluate the specific effect of connecting embedded generation or other technologies to new and existing networks

P10 Complete volt drop/rise and earth loop impedance calculations to support the design

P11 Identify the specific materials to be used, based on network owner requirements

P12 Produce an outline design of network with the POC parameters, specifications and materials included

P13 Upon finalisation of the design requirements, produce a formal design and engineering report with supporting risk assessment for final submission and approval

P14 Produce the final approved design pack and associate construction drawings, design documents for handover to the constructor

Knowledge and Understanding

General Requirements

To achieve this module, you will need to know and understand:

K1 LV network design principles as identified in the Asset Adopters technical documents

K2. The operational principles applicable to LV networks with embedded generation or other technologies connected

K3. The effect of connecting embedded generation or other technologies to new and existing networks

K4. The effect on LV network system performance, harmonic contributions and disturbing loads

Task Specific Requirements

K5. The ENA Standards as applicable to embedded generation and new and emerging technologies

Module 7 - HV Network Design - Underground Networks (up to 20kV)

This training specification details the skills and knowledge required to carry out the design of high voltage underground networks up to and including voltages of 20kV.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete high voltage underground design schemes taking into account relevant legislation, regulatory requirements, network specifications and load requirements.
- Being able to demonstrate a detailed knowledge of the theory and principles of high voltage underground cable network design
- Being able to conduct the self-determination of HV Point of Connections (POC) and Self Design Approval

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all Core Design Skills Modules
- Completed, as a minimum, a relevant ONC in electrical and electronic engineering or its equivalent

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification.

The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies
- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

General Requirements

To achieve this unit, you will need to be able to:

P1 Identify and interpret HV network technical information and the limiting parameters affecting each design

P2 Identify and Interpret client/asset adopter requirements to enable designs to be completed

P3 Identify customer and key stakeholder requirements to enable designs to be completed

P4 Produce designs which incorporate company commercial requirements and risk strategies

P5 Produce design packs for submission which include calculations, drawings and engineering reports.

P6 Obtain HV POC via application to the network owner or self-determine HV POC parameters from available information and guidance documents published by the network owner.

P7 Prepare bill of quantities and pricing schedules that reflect the design for costing and procurement purposes.

Task Specific Requirements

P8 Identify and interpret the effect of relevant Health, Safety and Environmental legislation, regulations and quality requirements on the design of HV underground networks

P9 Complete underground HV cable network designs considering existing and proposed network system parameters, the installed environment and the interface with overhead lines

P10 Obtain HV POC via application to the network owner or self-determine HV POC parameters from available information and guidance documents published by the network owner.

P11 Identify and interpret HV network design configurations and their operating requirements.

P12 Finalise the HV underground network design requirements, including formal design detail and engineering reports suitable for final submission

P13 Prepare bill of quantities and pricing schedule that reflect the design for costing and procurement purposes.

P14 Produce full Construction Design & Management (CDM) packs and their associated documents suitable for handover of the designed underground network for construction

Knowledge and Understanding

General Requirements

To achieve this module, you will need to know and understand:

K1. The requirements of relevant industry legislation and the obligations placed on asset owners

K2. The principals of HV network development, system parameters and security

K3. The principals of Protection and Control of HV Circuits

K4. The principals of Planning, Consents and Wayleaves in relation to network design

K5. The requirements of the G88 DNO/IDNO network interface

K6. The principles and purpose of Network Modelling

Task Specific Requirements

K7. The common cable types, sizes and specifications used in HV underground network design

K8. How to identify underground cable ratings and the factors which affect their rating

K9. The principles and techniques of cable installation and the installed environment

K10. The types of cable joints and plant terminations commonly used in HV underground cable networks

K11. How to identify the major manufactures' and suppliers of cable, cable joints and accessories approved by the ENA and asset owners/adopters

K12. The principles and implications of the interface with other HV systems

K13. How to identify potential points of connection considering availability of capacity, security and quality of supply and network operation.

K14. How to plan underground cable network routes with due consideration to the environment and interests of all 3rd party stakeholders and legislative obligations.

K15. How to design network extensions to meet the requirements of the asset adopter, codes of practice, installation techniques, material specifications and procedures.

K16. Identify all underground cable components for incorporation into the network design utilising the asset adopters approved equipment registers and specifications.

K17. How to prepare an underground material schedule.

K18. Prepare plans, maps and drawings to be used in documents for securing cable and property assets on private land.

Module 8 - HV Network Design – Overhead Line Networks (up to 20kV)

This training specification details the skills and knowledge required to carry out the design of high voltage overhead line networks up to and including voltages of 20kV.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete high voltage overhead line design schemes taking into account relevant legislation, regulatory requirements, network specifications and load requirements.
- Being able to demonstrate a detailed knowledge of the theory and principles of high voltage overhead line network design
- Being able to conduct the self-determination of HV Point of Connections (POC) and Self Design Approval

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core skills modules
- Completed, as a minimum, a relevant ONC in electrical and electronic engineering or its equivalent
- Completed Module 004 LV Design - LV Underground Networks
- Completed Module 005 LV Design - LV Overhead Networks

How will this module be assessed?

To achieve this unit you will need to provide evidence of achievement of the performance criteria and knowledge and understanding requirements detailed in this specification. The assessment of competence must be achieved using a minimum of ONE of the range of assessment methods listed below or a combination of the three methods listed.

- External assessment – an external assessment process conducted by an accrediting body
- Internal assessment – a company led ongoing assessment of evidence against the requirements of the specification/s
- Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

To achieve this unit you will need to provide evidence of competence in the performance criteria and the knowledge and understanding requirements listed. Evidence may include:

- Evidence Portfolios containing examples of completed design schemes, projects, witness testimonies
- Observation of work conducted, candidate presentations, documented interviews / reviews

Performance Criteria

General Requirements

To achieve this unit, you will need to be able to:

P1 Identify and interpret HV network technical information and the limiting parameters affecting each design

P2 Identify and Interpret client/asset adopter requirements to enable designs to be completed

P3 Identify customer and key stakeholder requirements to enable designs to be completed

P4 Produce designs which incorporate company commercial requirements and risk strategies

P5 Produce design packs for submission which include calculations, drawings and engineering reports.

P6 Obtain the HV POC via application to the network owner or self-determine HV POC parameters from available information and guidance documents published by the network owner.

P7 Prepare bill of quantities and pricing schedules that reflect the design for costing and procurement purposes.

Task Specific Requirements

P8 Identify and interpret the effect of relevant Health, Safety and Environmental legislation, regulations and quality requirements on the design of HV overhead line networks

P9 Complete HV overhead line network designs considering existing and proposed network system parameters, the installed environment and the interface with underground networks

P10 Identify and interpret HV overhead line network design configurations and their operating requirements.

P11 Finalise the HV overhead line network design requirements, including formal design detail and engineering reports suitable for final submission

P12 Produce full Construction Design & Management (CDM) packs and their associated documents suitable for handover of the designed overhead network for construction

Knowledge and Understanding

General Requirements

To achieve this module, you will need to know and understand:

K1. The requirements of relevant industry legislation and the obligations placed on asset owners

K2. The principals of HV network development, system parameters and security

K3. The principals of Protection and Control of HV Circuits

K4. The principals of Planning, Consents and Wayleaves in relation to network design

K5. The requirements of the G88 DNO/IDNO network interface

K6. The principles and purpose of Network Modelling

Task Specific Requirements

K7. How to read and interpret overhead line design specifications including pole spacing, conductor sag charts and stay arrangements

K8. The common conductor types, sizes and specifications used in HV overhead line network design

K9. How to identify overhead line conductor rating's and the factors which affect their rating

K10. The principles and techniques of overhead line conductor installation and the installed environment

K11. The types of overhead line structures and the configurations used in the design of HV overhead line networks, including their construction methods and clearances

K12. The purpose and principals of conducting overhead line surveys

K13. How to identify the major manufacturers and suppliers of overhead line conductors, fittings and accessories approved by the ENA and asset owners/adopters

K14. The principles and implications of the interface with other HV systems

K15. How to identify potential points of connection considering availability of capacity, security and quality of supply and network operation.

K16. How to plan overhead line routes with due consideration to the environment and interests of all 3rd party stakeholders and legislative obligations.

K17. How to design network extensions to meet the requirements of the asset adopter, codes of practice, installation techniques, material specifications and procedures.

K18. Identify overhead line components for incorporation into the network design utilising the asset adopters approved equipment registers and specifications.

K19. How to prepare an overhead line material schedule.

K20. Prepare plans, maps and drawings to be used in documents for securing cable and property assets on private land.

K21. The purpose and principles of control mechanisms and automation used for HV overhead line circuits

K20, Prepare plans, maps and drawings to be used in documents for securing electric line and property assets on private land

K23. The purpose and effect of the ESQC Regulations on the design of overhead line networks including their requirements in relation to anti climbing devices and preventing conductor contact.

Module 9 - HV Network Design – Substations (up to 20kV)

This training specification details the skills and knowledge required to carry out the design of high voltage substations, up to and including voltages of 20kV.

The specification details the minimum critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge requirements detailed by the specification within their own training programmes.

What does competence look like?

- Being able to complete substation designs which meet relevant legislative and regulatory requirements, network specifications and load requirements.
- Being able to successfully produce a substation design ensuring owner specifications, land foot-print requirements and suitability criteria are considered
- Being able to demonstrate a detailed knowledge of the theory and principles of substation design
- Being able to demonstrate a safe approach in the construction works design to eliminate and or control hazards and to reduce associated risks.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed a relevant C&G Level 3 vocational award or ONC in electrical and electronic engineering or their equivalent
- Successfully completed Modules 1 to 4, and 7 of Network Design Competence as a minimum

This specification details the required skills and knowledge to establish competence in the design of substation layouts for power networks.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

How will this module be assessed?

To achieve this unit, you will need to provide acceptable evidence of achievement relating to the performance criteria and knowledge elements and an understanding of the requirements detailed in this specification. The assessment of competence shall be achieved by using a minimum of ONE of the range of assessment methods listed below, or a combination of all three methods listed.

a) External assessment – an external assessment process conducted by an accrediting body

b) Internal assessment – a company led on going assessment of evidence against the requirements of the specification/s

c) Modular assessment – a summative assessment of evidence against each modules' listed requirements as they are achieved

What type of evidence will be required?

This module will be assessed through use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

The assessments shall establish the candidate has the relevant knowledge and experience for all aspects of Substation and associated Earthing Designs relating to power networks up to 20kV.

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters to be used for each type of substation design completed

P2. Interpret customer requirements to enable designs to be completed

P3. Demonstrate consideration to company commercial and risk strategies when completing a design

P4. Produce site specific risk assessment and evidence of implementation of the required control measures

P5. Produce the outline design pack(s) for submission including calculations, drawings etc

P6. Demonstrate that the site foot print area is suitable for the required application

P7. Demonstrate that substation designs have fully considered short circuit limitations, future extendibility, maintainability and operational flexibility

P9. Considering the appropriate fault levels, design a suitable substation earthing system

P8. Demonstrate that the substation design is a fit for purpose solution and meets technical and commercial requirements

P10.Produce formal detail design pack and engineering report for final submission and approval

P11. Produce the final substation design and associated construction design documents for handover to the constructor(s)

Knowledge and Understanding

To achieve this module, you will need to know understand:

K1. The principles of substation civil and electrical design

K2 The ESQC Regulations as appropriate to substation designs

K3. The CDM Regulations as appropriate to substation designs

K4. The Model Distribution Safety Rules as appropriate to the substation designs

K5. The Energy Networks Association Technical Standards (ENATS) and industry best practices relating to distribution substations and associated earth designs

K6. The Energy Networks Association Technical Standards (ENATS) and industry best practices relating to environmental performance i.e. flood prevention, EMF's, noise and vibration

K7. The Legal requirements relating to land ownership, purchasing and or leasing an appropriate sized parcel of land for substation construction, associated cabling, operational access and egress

K8. What civil requirements have been considered and what is their impact on substation design

K9. How will different ground conditions impact on substation designs and what mitigation measures will be required

K10. The implications of substation designs and their impact on other systems in relation to the design produced

K11. How the substation design accommodates designated safety clearances, operational and maintenance requirements

K12. How substation designs will meet future requirements in terms of access/egress, maintenance and alteration

K13. How the selection of switchgear and transformers meets operational and owner requirements

K14. How hazards that have been identified have been eliminated or controlled in the substation design

Module 10 – EHV Design Skills

Substation Layouts for a Safe Working Environment (above 20kV to 132kV)

This training specification details the required skills and knowledge to establish competence in the design of substation layouts for a safe working environment, power networks.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to successfully produce a substation design ensuring owner specifications, land foot-print requirements and suitability criteria are considered
- Being able to describe the knowledge and principals required to complete an EHV substation design
- Being able to demonstrate a safety approach in the construction works design to control/eliminate hazards and to reduce their associated risks.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of Substation Earthing System Design (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria

- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters to be used for each design being completed

P2. Interpret customer requirements to enable designs to be completed

P3. Demonstrate consideration to company commercial and risk strategies when completing a design

P4, Produce the design pack(s) for submission including calculations, drawings etc

P5. Produce site specific risk assessment and evidence of implementing the required control measures.

P6. Demonstrate that the site foot print area is suitable for the required application

P7. Demonstrate that the substation design has considered future extendibility, maintainability, operational flexibility and short circuit limitations.

P8. Demonstrate that the substation design is a fit for purpose solution and meets technical and commercial requirements

P9. Produce an outline design of substation layout

P10. Identify the site fault level from the owner and choose the required earthing conductor (duplex/spur) as per the specification.

P11. Produce formal detail design pack and engineering report for final submission

P12. Produce the substation design pack and associated construction design documents for handover to the construction team

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The safety rules and national safety instructions as appropriate to the EHV substation design

K2. The CDM Regulations 2015 as appropriate to EHV substation designs

K3. EHV substation design relevant standards

K4. The principles of EHV substation design specification ENA TS

K5. The impact on the design of the design and interface requirements between DNO, OHL and third party interface as detailed in Asset owner handbook

K6. The implications of EHV substation designs and the interface with other systems relevant to the design produced

K7. The civil considerations that have been taken into account and their impact on HV substation layout designs

K8. How the design meets the substation future requirements in terms of extendibility, maintainability and operational access

K9. How the selection of bus bar configuration in the substation design meets owner requirements

K10. How hazards have been controlled/eliminated in the substation design

K11. How the substation design meets appropriate safety clearances, insulation requirements and maintenance clearances

.

Module 11 – EHV Network Design

EHV Design - Switchgear and Capabilities (above 20kV to132kV)

This training specification details the required skills and knowledge to establish competence in switchgear and capabilities in power networks design

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to identify the appropriate switchgear to be used in designs and articulate the rationale for the selection using the principals of EHV substation switchgear
- Being able to describe the merit and demerit of switchgear

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of EHV switchgear and their capabilities (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria
- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters for each type of switchgear to be used

P2. Interpret customer requirements to enable appropriate selection of switchgear

P3. Demonstrate consideration to company commercial and risk strategies

P4. Demonstrate that the type of switchgear chosen meets the owner requirements and application

P5. Demonstrate that the switchgear chosen considers future extendibility, maintainability, operational flexibility and short circuit limitations

P6. Demonstrate that the switchgear choice is a fit for purpose solution and meets technical and commercial requirements

P7. Demonstrate that the switchgear selection suits the environmental and the site specific location

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The impact and requirements of Safety rules and national safety instructions on the selection of EHV switchgear

K2. The standards, parameters and specifications of EHV switchgear in order to make the appropriate selection

K3. The impact of the principles of EHV switchgear specification ENA TS

K4. The implications of the interface with other systems

K5. The implications on the choice of EHV switchgear of EHV switchgear parameters and their limitations

K6. How the choice of switchgear meets the substation future requirements in terms of extendibility, maintainability and operational access

K7. How the selection of bus bar configuration in the substation design meets owner requirements

K8. How the switchgear choice meets the substation safety clearances, insulation requirements, maintenance clearances, environmental and pollution requirements

Module 12 – EHV Design Skills - Substation Earthing System Design (above 20kV to 132kV)

This training specification details the required skills and knowledge to establish competence in substation earthing system designs, power networks.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to identify and demonstrate that network designs comply with the earthing system requirements and relevant standards
- Being able to describe the knowledge and principals required to complete an earthing system design, paying particular attention to hot and cold site identification
- Being able to produce an accurate earthing system design, which meets all standards, regulations and customer requirements and demonstrates consideration of specification and site fault level

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of Substation Earthing System Design (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria

- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters to be used for each design being completed

P2. Interpret customer requirements to enable designs to be completed

P3. Demonstrate consideration to company commercial and risk strategies

P4, Produce the design pack(s) for submission including calculations, drawings etc

P5. Identify the site fault level from the owner and choose the required earthing conductor (duplex/spur) as per the specification.

P6. Identify site specific risk assessment, hazards and implementing the control measure required

P7. Obtain the earthing study report from the owner or if appropriate obtain an eathing study in line with company processes and procedures

P8. Use the earthing study report to identify the site as Hot / Cold, the touch / step potential value within limit and recommendation for earthing system design and identify if any special arrangement is required

P9. Produce an outline design of below ground earthing system, specifications and materials list included

P10. Produce an above ground earthing system including specifications and materials list

P11. Produce formal detail design pack and engineering report for final submission

P12. Produce the full earthing design pack and associated construction design documents for handover to the construction team

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The impact and requirements of appropriate owner specifications for Earthing System Design

K2. The principles of earthing systems ENA TS 41-24 and Regulation BS7671

K3. The design and interface requirements between DNO and third party interface(s) as detailed in the Asset owner handbook

K4. The criteria for selection and use of appropriate earthing materials as detailed in the Asset Owner handbook and specifications

K5. The implications of the interface with other systems

K6. The earthing systems design of the appropriate HV substation(s)

K7. The impact on the design of ground fault current and grid current calculation

K8. The impact of the appropriate conductor selection based on fault current

K9. The touch and step potentials of the earthing system design

K10. Ground Potential Rise (GPR) and grid resistance as they impact on the earthing system design

K11. Site impedance as it impacts on the earthing system design

Module 13 – EHV Design Skills - Vector Groups (above 20kV to132kV)

This training specification details the required skills and knowledge to establish competence in Vector Groups (above 20kV to132kV), power network design.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to explain the principals of vector groups as part of EHV power network designs
- Being able to successfully complete a substation phasing diagram taking into account the owner requirements

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of EHV vector groups (above 20kV to 132kV), power networks..

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria
- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters to be used for each diagram being completed

P2. Interpret customer requirements to enable designs to be completed

P3. Produce a site specific phasing diagram

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The impact and requirements of Safety rules and national safety instructions as appropriate to EHV vector groups

K2. The implications of EHV vector groups on the interface with other systems

K3. The implications and considerations of EHV vector groups on EHV substation design

K4. The electrical principal applicable to vector groups and phasing diagrams

K5. The impact on vector groups of phasing arrangements

K6. The considerations taken into account in selecting appropriate Vector groups

Module 14 – EHV Design Skills - EHV Protection Systems (current (IDMT), unit, distance, earth fault) (above 20kV to 132kV)

This training specification details the required skills and knowledge to establish competence in EHV Protection Systems required for power network substation designs.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to select and justify an appropriate an EHV substation network protection system
- Being able to successfully complete an EHV protection system design supported by operation theory

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of Substation Earthing System Design (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria
- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Identify the correct specifications and limiting parameters to be used for each design being completed

P2. Interpret customer requirements to enable designs to be completed

P3. Demonstrate consideration to company commercial and risk strategies

P4, Produce the design pack(s) for submission including calculations and settings

P5. Identify and include in the design the correct type of relay/switchgear as per the owner specification, taking into account the application of the relay/switchgear

P6. Identify the appropriate relay/switchgear type and demonstrate that it considers future extendibility, maintainability, operational flexibility and short circuit limitations

P7. Demonstrate that the relay/switchgear choice is a fit for purpose solution and meets technical and commercial requirements

P8. Demonstrate that the relay/switchgear selection suits the environmental and the site specific location

P9. Produce a formal engineering report for final submission including all details and final protection requirements

P10. Produce the full pack and associated design documents for handover to the site team

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. The impact and requirements of Safety rules and national safety instructions on the selection of protection systems appropriate for the design

K2. The principals of operation of protection systems including current, unit, distance, earth faults

K3. The operation theory of protection systems

K4. The criteria for selection and use of appropriate relays based on their application

K5. The impact of the principles of EHV switchgear specification ENA TS

K6. The implications of the interface with other systems

K7. The impact of relay parameters and their limitations on the design

K8. The types of protection available, including overcurrent, earth fault, distance, differential, unit, bus bar and the impact and considerations of each

K9. The consequences of protection failure on the design

K10. The implications of fault current and fault clearance time on the design

K11. The criteria to choose relay/switchgear that meets the substation future requirements in terms of extendibility, maintainability and operational access

K12. Protection system knowledge relevant to EHV substation design

K13. The principles of EHV substation switchgear specification ENA TS

K14. The principles of single/3 phase protection requirements

K15. The considerations required insuring environmental and pollution requirements are achieved

Module 15 – EHV Design Skills - EHV Cable System (above 20kV to 132kV)

This training specification details the required skills and knowledge to establish competence in EHV cable system designs required for power networks.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete an EHV Network Design, involving the selection and specification of underground cables, routes and installation methods on networks above 20kV to 132kV
- Being able to demonstrate technical knowledge of the factors influencing cable and joint selection, ratings and installation methods using manufacturers' data, network loading models, and interactive thermal effect studies.
- Being able to demonstrate knowledge of the factors influencing cable route selection involving, works in the highway, interactions with other utility assets, environmental characteristics, third party land, protected areas and structures.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of Substation Earthing System Design (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria
- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Interpret client/asset adopter requirements to enable the design to be completed

P2. Interpret manufacturers' cable data sheets and installation guidance to enable the design to be completed

P3. Interpret EHV electrical design drawings and specifications to enable the design to be completed

P4. Identify the correct specifications and limiting parameters for EHV cable asset and the impact on design route selection

P5. Demonstrate consideration to company commercial and risk strategies

P6. Produce the design pack for submission including calculations, drawings, asset specification

P7. Identify the specific cable types, drum length, joints and terminations to be used in the design, based on network owner/adopters requirements

P8. Populate the relevant system model with appropriate cable asset characteristics

P9. Produce formal design engineering report for final submission, including all design requirements and formal design detail

P10. Produce the full CDM pack and associated construction design documents for handover to the construction team

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. EHV network design principles as identified in Asset Owners G81 documents

K2. The impact on cable system design of NGT Transmission network design principles above 132kV to ensure compliance

K3. The implications of upstream and downstream embedded generation on cable system designs

K4. The effect on EHV networks system performance, harmonics and disturbing loads on cable system design

K5. The principles of EHV network earthing systems and cable sheath bonding on cable system designs

K6. The principles of EHV protection systems including circuit breakers, protection, relays, fault throwers, basic fault calculations on cable system designs

K7. The design and interface requirements between DNO and IDNOs as detailed in G88

K8. The operational principles applicable to EHV networks and circuit configurations as appropriate to cable system design

K9. The selection and use of appropriate equipment and materials for cable system designs as detailed in the Asset Owner G81

K10. The EHV electrical design and protection requirements and how to interpret and apply them to cable system designs

K11. The relevant EHV cable system models and studies and how to interpret and apply them to cable system designs

K12. The impact of load flow, Volt drop and system security studies and how to interpret and apply them to cable network designs

K13. The impact of associated EHV network assets including substations, overhead lines and NGT Transmission systems and how to interpret and apply the impact to cable system designs

K14. The content requirements of full CDM pack and associated construction design documents for handover to the construction team as appropriate for cable system designs

Module 16 – EHV Design Skills - EHV Overhead Line System (above 20kV to 132kV)

This training specification details the required skills and knowledge to establish competence in EHV overhead line system designs required for power networks.

The specification details the critical requirements of the activity to establish competence and does not preclude employers from adding to the skills and knowledge detailed by the specification in their own training programmes.

What does competence look like?

- Being able to complete an EHV Overhead Line Network Design, involving the selection and specification of overhead line routes, profile surveys and construction methods on overhead line systems above 20kV to 132kV.
- Being able to demonstrate technical knowledge of the factors influencing overhead line construction and conductor, ratings and installation methods using manufacturers data, network loading models, and interactive thermal effect studies.
- Being able to demonstrate knowledge of the factors influencing overhead line route selection involving, terrain, works over highways, water courses, proximity to other buildings/structures and natural features such as tree, environmental characteristics, third party land, protected areas and visual impact.

What do I need to undertake this module?

Candidates to be assessed as competent in this module should have –

- Completed all core power networks design modules
- Completed, as a minimum, an appropriate Electrical & Electronic BTEC HNC/HND or equivalent

How will this module be assessed?

This module will be assessed through the use of work based evidence (work logs, examples of work, on-going local assessments with reviews and feedback), gathered by the candidate in relation to all criteria.

All assessments will be undertaken by a company/external representative deemed to have the relevant knowledge and experience of all aspects of Substation Earthing System Design (above 20kV to 132kV), power networks.

Assessments may be undertaken by:

- External assessment – external accrediting body
- Internal assessment – company led ongoing assessment to demonstrate competence against the criteria

- Module Final assessment, to determine competence against all the listed requirements, will be an assessment of the evidence provided

Performance Criteria

To achieve this unit, you will need to be able to:

P1. Interpret client/asset adopter specifications to enable the correct overhead line design to be completed

P2. Interpret manufacturers' overhead line poles and equipment data sheets and installation guidance to enable the design to be completed

P3. Interpret EHV electrical design drawings and specifications to enable the design to be completed

P4. Identify the correct specifications and limiting parameters for EHV overhead line and the impact on design route selection

P5. Demonstrate consideration to company commercial and risk strategies in the design

P6. Produce the design pack for submission including surveys, calculations, drawings, asset specification

P7. Identify the specific overhead line construction and conductor type to be used in the design, based on network owner/adopters requirements

P8. Identify the specific overhead line data to be used in surveying the route and determining the key equipment required to complete the construction to the design specification.

P9. Demonstrate that appropriate overhead line surveying methods and profiling mapping have been used

P10. Demonstrate the application of established principals of overhead line design and route selection minimising the impact on the environment, land owners and the general public, to optimise early third party agreement to the design.

P11. Produce the formal engineering report including the formal design detail.

P12 Produce the bill of quantities including poles, steelwork, insulators, terminations and stays to support the final submission and pricing.

P13. Produce the full CDM pack and associated construction design documents for handover to the construction team

Knowledge and Understanding

To achieve this module, you will need to know and understand:

K1. EHV network design principles as identified in Asset Owners G81 documents

K2. The impact on overhead line system design of NGT Transmission network design principles above 132kV to ensure compliance

K3. The implications of upstream and downstream embedded generation on cable system designs

K4. The effect on EHV networks system performance, harmonics and disturbing loads on overhead line system design

K5. The principles of EHV network earthing systems and cable sheath bonding on overhead line system designs

K6. The principles of EHV overhead line lightening protection on overhead line system designs

K7. The principles of EHV protections systems including circuit breakers, protection, relays, fault throwers, basic fault calculations on overhead line system designs

K8. The design and interface requirements between DNO and IDNOs as detailed in G88

K9. The operational principles applicable to EHV networks and circuit configurations as appropriate to overhead line system design

K10. The selection and use of appropriate equipment and materials for overhead line system designs as detailed in the Asset Owner G81

K11. The EHV electrical design and protection requirements and how to interpret and apply them to overhead line system designs

K12. The relevant EHV overhead line system models and studies and how to interpret and apply them to overhead line system designs

K13. The impact of load flow, Volt drop and system security studies and how to interpret and apply them to overhead line system designs

K14. The impact of associated EHV network assets including substations, cable systems and NGT Transmission systems and how to interpret and apply the impact to overhead line system designs

K15. The content requirements of full CDM pack and associated construction design documents for handover to the construction team as appropriate for overhead line system designs

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