

# **Proposed ETA Engineering Skills and Qualifications Framework**

## **(Discussion Paper)**

### ***1. Introduction***

A need has been identified, by a number of ETA member companies, for a common inter company skills and qualifications framework for employees engaged in engineering related roles within the ESI. There is a belief that to replicate work on independent frameworks is wasteful of resource and fails to take advantage of the cross sector co-ordination possibilities offered by the Electricity Training Association, operating in its new role as National Training Organisation (NTO) for the sector.

Benefits are seen to include the ability to monitor existing skill bases and plan for their future maintenance more efficiently and reliably - the ability to spread the production costs of up to date multi-media learner support products - and the provision of a platform for building on the many recent external developments in engineering qualifications and standards. Additionally, a robust commonly agreed view of the skill profiles for Industry standard general roles, greatly increases the possibilities for collaboration in the development and procurement of externally accredited schemes of training for new recruits and up-skilling initiatives.

Collaboration at this common high level should not be viewed as being incompatible with competition; efficiency gained in reducing replication of effort will be of benefit to the Industry as a whole.

This discussion paper has been commissioned to explore the relevant issues and outline a possible way forward. Enough detail has been included to help interested parties decide whether or not to register their support, as potential future users, or development partners.

### ***2. Background***

Pre-privatisation the forerunner of the ETA, the Electricity Supply Industry Training Committee (ESITC), coordinated the production of a comprehensive suite of training recommendation standards. These recommendations set out in some detail, using a method known as the Systematic Approach to Training (SAT), itemised descriptions of the skills required for virtually all categories, and levels, of ESI engineering staff. The skills for each category (e.g. Distribution Graduate trainee, Power Station operator etc) were decomposed into sets of measurable objectives and each objective was described in terms of related Performance, Conditions and Standards parameters. The CEGB and the Area Boards were then able to use these detailed objectives to develop training (on and off-job) and assess performance skill by skill. In practice the detailed approach was found to be most suitable for the Craftsmen/Operator levels whose duties were focused on performing set procedures to high standards. Though still itemised in detail, objectives for Engineering roles were less easy to specify so tightly due to their potential diversity, and a slightly looser form of language was used. (Can demonstrate knowledge of..., Understands the requirements for... etc.).

Overall, the net result was that the Industry as a whole had a common reference base for skills, which worked well in its day, and helped maintain what was commonly regarded as a very highly skilled workforce.

However, over the last twelve years the environment for engineering skills management in the ESI, and nationally, has changed radically - Significant changes include:

- a) Dramatic manning level reductions. This creates a far more challenging environment for the gradual infusion of skills on-job than was previously enjoyed. This is especially significant for those companies with limited (or no) direct access to training centre facilities.
- b) There is now, generally, a much more realistic match of academic background and intellectual calibre to job role. Previously, it was common to find engineering staff who were inherently 'overqualified' for their on-going work demands. Again, and combined with generous manning levels, learning the job 'as you go' and adapting to new situations at the work place, was much more easily absorbed as part of everyday life.
- c) The ESITC 'Systematic Approach to Training' has fallen into general disuse over the last twelve years (in the UK at least) and has been overtaken by the outcome based competency approach of National Vocational Qualifications (S/NVQ). These are currently mainly applied to the Craftsmen/Operator level as ETA level 2/3 qualifications. The approach differs from SAT in that NVQ Competencies are concerned with 'functions' whereas SAT looked at individual 'tasks' one by one. (e.g. an NVQ might refer to 'Joining conductors' whereas SAT would look at each type of joint.) However, the relevance here is that NVQ assessment requires portfolios of evidence to be produced that demonstrate competence in relevant functions over representative ranges of 'tasks'. (This distinction will be important when a simplified method of 'assessment' is proposed for higher engineering levels later)
- d) The Engineering Council and with it the (IMechE, IEE, IIE) have changed the training/development requirements for membership twice in the last twelve years. The first, around 1989, called for formal Institution approval for Chartered and Incorporated Engineer development schemes, which along with the fragmentation of the ESI, is what led to the rapid decline in use of the relevant ESITC recommendations post-privatisation. The second, which is now being phased in, (SARTOR 97), is much more radical and has eliminated the concept of a time served (two year) training programme all together. Instead, candidates are now expected to provide evidence that they have developed a broad range of, mainly personal, engineering related competencies over an unspecified period. Developing schemes to meet these new requirements appears as one of the strong drivers for this proposed *ETA Engineering Skills and Qualifications Framework*.
- e) The fragmentation and competitive nature of the modern UK ESI has inevitably led to the loss of much of the ad-hoc collaboration and spreading of resource on universally required training initiatives. The ETA exists, partly, to act as a coordinator in this area and has produced significant collaborative training and

qualification products for general uptake. These include the Modern Apprenticeship templates which integrate syllabus based courses, NVQ's, and training for the Craftsmen/Operator occupations.

These changes, taken together with demands for efficiency in company HRD support arrangements, and commonly reported demographic mismatches, would appear to have created the conditions for the re-introduction of closer inter-company collaboration to develop the proposed *ETA Engineering Skills and Qualifications framework*. This would extend the current arrangements for Craftsmen/Operators and include appropriate coverage for all levels of Engineering staff.

### **3. Outline Requirements**

The overall goal is clearly to have the right number of engineer/craftsmen/operators at the right skill level at the right time. The requirements of a common Skills and Qualifications framework, in order that it may be used to help achieve this goal, may be considered under two main headings - a) Planning and b) Implementation.

- a) **Planning** - Quantification of the above parameters is obviously an internal matter for company strategists and HR planners. However, this process could be greatly streamlined with the availability of a robust engineering skills framework to assist modeling and inventory analysis. Especially so, if the framework is available electronically in a standard database format. This implies, that the framework should be stable and widely applicable enough to input to the development of shared staff development and recruitment specifications. Additionally, it should be flexible enough to be adaptable to the requirements of individual companies and operating units. Suggesting some sort of modular role definition capability. Where a skills specification (or partial specification) is substantial enough and applicable to viable numbers then it may make sense to consider formalising it into a Qualification. If a Qualification is applicable to a broad, sector wide, audience then inter company collaboration and, external accreditation and Q/A, becomes increasingly desirable.
- b) **Implementation** - Having accurately defined requirements for numbers, skill levels and time scales, it is usually necessary to design, develop and facilitate enabling learning interventions. This can be a lengthy and resource intensive activity (especially for formalised qualifications). All other factors being equal there are obvious advantages in spreading this across the sector. This places a requirement on the framework to be as widely applicable as possible so that consensus on content definitions can be reached easily and quickly. Historically this has often been found to require lengthy working groups and steering committee based projects.

Typical candidates for a collaborative approach might include:

- Qualification definition and assessment and external validation initiatives
- Template new entrant training schemes
- Up skilling modules and schemes
- IEE/ IMechE/ IIE approved scheme templates
- Development of traditional and modern multi-media learning support materials e.g. Open Learning courses
- Assessment strategies and external quality assurance arrangements for work place Competence assessment
- Tutor support networks to assist the encouragement of self-managed learning

In order to gain wide spread acceptance and take-up the framework must be designed in such a way as to enable and assist these types of initiatives.

It is most unlikely that all companies will be interested in all of the foregoing and any proposed way forward must include a consultation stage. This is to enable a consensus to be reached regarding scoping, likely demand, and prioritisation. However, for this concept to proceed any further at all there will be, as a minimum, a need to develop an outline *ETA Engineering Skills and Qualification framework*. In order to assist meaningful debate regarding the possible eventual form of such a framework, a draft proposal has been developed as an example. This draft framework is available from the ETA, on CD, in database format to enable further investigation and manipulation if required. The following sections describe this framework and its underlying philosophy.

#### ***4. Proposed ETA Engineering Skills Framework***

By consensus, both within the ESI and in the wider engineering community, it is convenient to group engineers and craftsmen/operators into four main headings:

Engineer/Manager/Specialist  
Engineer/Supervisor/Operator  
Technician/Supervisor  
Craftsman/Operator

Historically they may have been called Engineer, Technician, Foreman, Craftsman, and in terms of their potential formal professional qualifications they align with Chartered Engineer (CEng), Incorporated Engineer (IEng), Engineering Technician (Eng Tech) and Modern Apprentice (MA). Additionally, in the ESI it is also

necessary to differentiate these groups by vertical sub sector - Generation, Transmission and Distribution.

For reasons of external sensitivity, the following working nomenclature has been adopted for the resulting twelve framework headings and generic qualification titles:

QG4 ETA Certified Generation Engineer II  
QG3 ETA Certified Generation Engineer I  
QG2 ETA Certified Generation Technician  
QG1 ETA Certified Generation Craftsman/Operator

QT4 ETA Certified Transmission Engineer II  
QT3 ETA Certified Transmission Engineer I  
QT2 ETA Certified Transmission Technician  
QT1 ETA Certified Transmission Craftsman

QD4 ETA Certified Distribution Engineer II  
QD3 ETA Certified Distribution Engineer I  
QD2 ETA Certified Distribution Technician  
QD1 ETA Certified Distribution Craftsman

In order to develop the framework each of these headings must be expanded in such a way that it relates to actual people doing actual jobs.

### ***5. Skill Profiles and Jobs***

Call to mind a 'highly effective' practicing individual, whose work activities support general alignment with one of these twelve framework headings, and that you personally know and respect.

If you ask yourself the question "What is it that person knows, and is able to do, that makes me consider him/her 'highly effective'?" Your answer will probably include a list something like the following, using 'everyday' language:

1. Adequate academic qualifications and theory grounding.
2. Attitude and behaviour that fit well with the workplace culture.
3. A sound personal approach adaptable to new work related situations.
4. Experience of undertaking engineering activities in a logical manner and to high standards.
5. Good ability to supervise/manage and work with people and a good appreciation of the financial, project, quality and information issues related to their activities.
6. Good experience of their general work areas and an understanding of the underlying principles and methods.

7. Experience of the specific plant/equipment processes, safety procedures, etc actually encountered on a day to day basis, and the ability to use documentation, manuals, work specifications etc to transfer from known situations to related new situations.

Clearly, the wording will alter with the level being considered and the type of work, but these are commonly accepted to be the general requirements of a 'sound' Engineer/Craftsman/Operator.

The proposed framework therefore groups skills/competencies under the following six clusters:

ETA QL1	Theory and Principles
ETA QL2	Personal Competence
ETA QL3	Engineering competence
ETA QL4	Supervision/Management/Business and Health and Safety
ETA QL5	Job (modular Roles)
ETA QL6	Job (Workplace specific)

Over the past decade a very large amount of work has gone into a wide variety of diverse competence and skills analysis initiatives, both nationally and for internal/collaborative ESI company training developments.

Annexes 6, 7, 8 and 9 show how this can be pulled together for a first draft framework for the four levels of Transmission Engineer/Craftsmen.

Each of these headings expands into sub-heading and individual competencies and job skills. Together they provide a repository of competence and skills from which selections can be made to define standard template profiles for generic person/job descriptions.

As can be seen from the examples at Annexes 10 and 11, these rapidly build to contain a large number of entries. This makes it desirable to manage the framework in electronic database form. (This has been set up for the draft and is available in CD format from the ETA). However, it is important to note that the framework can be employed, top down, at any level of detail required - starting with just the top level 12 headings.

### ***Modular Roles***

The headings in ETA QL5 for each level take the form of modular roles. This simplifies the assembly of particular profiles and offers a way to manage subsequent external assessment without having to impose prescribed inflexible standard profiles. The CD software allows simple 'copying and pasting' to facilitate this.

The level of detail required will clearly vary with application of the Framework. Sector-wide Skills Foresight surveys and company skills planning, for example, will only require consideration at the role/profile level; whereas qualification syllabus development will need to specify the requirements of each profile in greater depth.

As a quick example of how the framework leads to qualification specification, it will readily be seen from the ETA Certified Transmission Craftsman Framework that the current Modern Apprenticeship qualification naturally emerges. (In fact the role entries at ETA QL5 have been taken directly from the NGC approved Modern Apprenticeship Scheme).

### ***7. Framework level content***

Briefly looking at the form of the content in each level the following general principles apply. (The Annexes show excerpts from an example category (QT3 ETA Certified Transmission Engineer I) as an illustration). Relating the content to your own 'profile' is sometimes a useful technique when evaluating possible application to others.

#### ***ETA QL1 – Theory and Principles***

This is concerned with foundation knowledge and includes entries for discipline-specific basic knowledge, e.g. Power System Theory, which will probably be common to all profiles though at different depth requirements e.g. (C&G 232 for Craftsmen; Undergraduate option level for Graduates, etc).

Also included are subjects such as Electronics Theory, which would be a requirement for a Telecomms Engineer profile, for example. Standard SARTOR matching sections to enable HND recruits to satisfy IEng requirements, say, would also be included for optional inclusion in profiles as required.

#### ***ETA QL2 – Personal Competence Model***

This includes the MCI-produced General Attitude and Behaviour Model (Although Company specific variants could be substituted here) and the Engineering Council SARTOR A – E competencies - mainly engineering-orientated personal/professional - and varying with each of the three registration levels. For Craftsmen/Operator levels these could be adapted further or a separate set could be drafted.

#### ***ETA QL3 – Engineering Foundation Competencies***

For the higher framework group this would be covered by the nationally agreed OSCEng generic engineering competencies; for the Craftsman/Operator they would be the appropriate ETA S/NVQ 2/3.

#### ***ETA QL4 – Supervision/Management/Business and Health & Safety***

For this level the MCI A – H structure is appropriate, with individual 'depth' (see later) varying with qualification level and, of course, profile requirements. For ETA Certified Technician level it may be more appropriate to use the NEBSM level 3 S/NVQ structure. (Note how the ETA/OUVS ETM 4 qualification would emerge naturally as a combination of selections from ETA QL3 and ETA QL4)

### ***ETA QL5 – Job (modular Roles)***

This is specific to the range of roles that may be expected to be performed but is general in nature. In other words it would not expect to deal with each item of Manufacturer's plant or every possible Safety Authorisation. It is meant to denote a general technical grounding and capability to master new situations based on experience of previous ones.

(care must be taken in deciding where to draw this line, however – the recent Southall rail crash investigation, for example, revealed faulty diagnosis of the condition of the Signal audible warning equipment – did the maintenance staff have experience of similar equipment and be expected to work on a different specific type ?) The entries in the ETA QL5 level are in a modular role format, designed to enable the building of profiles (and assessment specifications) by assembling selected role building blocks.

### ***ETA QL6 – Job (Workplace specific)***

This level is concerned with the specific requirements at the workplace (e.g. specific plant processes, procedures and authorisations, etc.) As will be discussed later, this level is not particularly amenable to forming part of an external qualification since it is Company and situation specific. It is likely that skills development and assessment of this essential part of any given profile, would remain within the realm of the employing company/location with, perhaps, an overarching statement of achievement for external accreditation and Q/A (if required).

The example includes reference to particular Manufacturers and types of equipment, local safety authorisations, local commercial practice, etc. In many cases specific 'Training' for variations in situations (Different Manufacturers Plant and types) etc will not be appropriate – rather the generic skills of ETA QL5 would be deployed in conjunction with manuals/procedures/work specifications etc and related previous experience would be deemed to suffice. However, whatever method is used to reach a satisfactory level of capability to work in very specific situations, there will always be a requirement for Line Managers to satisfy themselves that it is effective and adequate. The consequences of not doing so can sometimes be only too obvious. (see earlier comment)

### ***Skills and Knowledge: Depth of Coverage***

In the example draft Framework for Transmission it can be seen that the skills and competence total repository for the ETA Certified Transmission Engineer I and ETA Certified Transmission Engineer II are virtually the same.

This is because, in many areas, the skills/competence areas will be the same but what will be different in the profiles is the required 'depth'. This commonsense notion should not be confused with the formal NVQ concept of pass/fail assessment. For example, the designer of a specific item of plant would be expected to know more about it and be able to do more with it than an Operator of the same plant.



The Draft Framework proposes a simple, short hand method of ‘quantifying’ this depth; Two, commonly agreed, rating scales are applied to describe knowledge depth (k) and proficiency depth (p) – so a designer may be k = 8, p = 8 for example and an operator may be k = 5, p = 5 (on a scale of 0 – 9)

This provides a convenient short hand method of specifying ‘depth’ of coverage requirement in individual Profiles and Qualification syllabus entries and a benchmarking performance in situations where the full rigour of NVQ 'D32/D33' assessment is not deemed appropriate.

## 8. *Qualifications and Assessment*

If local Job/Person descriptor profiles were all that were required from the Framework then the process would be relatively straightforward – simply select the most appropriate Framework entries in the appropriate framework category, ‘copy and paste’ entries into a new profile and assign k and p 'depth of coverage' ratings.

Unfortunately, with a qualifications framework, issues concerned with externally assured assessment manageability, complicate matters - The requirement to have flexibility and match a profile to any required job description suggests the need to generate a range of qualification profiles within any of the twelve framework categories. (e.g. Mechanical, Electrical, C&I etc). However, the requirement to have manageable external quality assurance built into to the qualification design, suggests the need to limit (or ignore) the variations.

This dichotomy has been addressed in the level 2 and 3 ETA NVQs by pushing the specifics implicitly into the range and specifying ‘routes’ to achievement. In the Modern Apprenticeship this is complemented with a traditional knowledge orientated examination to a set syllabus e.g. C&G 232. The Job Specific ‘role’ components of the Modern Apprenticeship must be assessed locally (Training Centre/On-Job).

This implies that a similar assessment strategy could be employed for the Framework category ETA Certified Craftsman/Operator level (i.e. basically the existing MA's). However, as the Framework categories progress upwards, breadth and depth of the job role level (ETA QL5) become more dominant and extensive in scope.

One approach that has been suggested is to modularise the Job Roles and profile components and provide quality assured assessment that can be undertaken in a similarly modularised manner.

Looking at the overall Framework level structure ETA QL1 – ETA QL6, it can be seen to fall into four natural assessment groupings:

- |    |   |                 |
|----|---|-----------------|
| 1) | Knowledge Assessment                                      | ETA QL1         |
| 2) | Competence Assessment<br>including underpinning knowledge | ETA QL2-QL3-QL4 |
| 3) | Job Roles Specific<br>(Skills and Knowledge)              | ETA QL5         |

4) Workplace Specific  
(Skills and Knowledge)

ETA QL6

Assuming Category 4 'Workplace Specific' is excluded and dealt with locally and the Framework ETA Q(G/T/D)1 categories (i.e. Craftsmen/Operators) are already adequately covered by the current set of Modern Apprenticeships; it is proposed that the following methods of assessment could be adopted:

***ETA QL1 – Theory and Principles***

This is predominantly knowledge based and amenable to testing by examination. Due to diversity this should be by HE/FE/Training Provider examinations approved by the ETA (or on their behalf).

It will need to be demonstrated that all the ETA QL1 profile entries have been covered by examination or exemption. (A Graduates final year option topics, for example.)

***ETA QL2-QL3-QL4***

This is competence based and amenable to 'sub-NVQ' Engineering Council rating style assessment (see SARTOR 97). Effectively this requires a network of internal informal assessors (i.e. D32/D33 NOT mandatory) who assign ratings to all competencies in a given profile. The assessment process should, however, be Quality Assured by the ETA (or on their behalf).

***ETA QL5 – Job Role Specific (Modular)***

This is skills and knowledge based. The knowledge base could be tested by an ETA governed (i.e. set and maintained on their behalf) set of examinations held simultaneously, across the sector, once per year (say in June). A separate examination would be required for each level in each section (9 papers). Candidates would only be expected to answer questions relating to Role Modules in their profiles. The proficiency component of each skill could be assessed by in-company (on-job/Training Centre) informal assessors using a SARTOR-style rating system.

This would be Quality Assured by the ETA (or on their behalf)

The roles would be recorded on the certificate as options for the initial qualification. Subsequent, successfully assessed and examined roles could then be added as endorsements (much like the old HNC approach). The groupings in the ETA QL5 categories are arranged to approximate to roles for convenience. In practice finer control of the role definitions would be achieved by building them from any arbitrary selection of skills and/or competence. This is why it will be necessary to have a

simple mechanism for the ETA (or their representatives) to agree role definitions at delegate registration to ensure parity between candidates (see below). (The IEE, for example, used to offer this type of service when graduates registered for their old style formation training.) The CD software enables simple 'copy and pasting' of skills and roles to facilitate this process.

In order to achieve parity of assessed Profiles across the sectors and maintain responsiveness and flexibility, participating companies would register their candidates and submit their proposed profiles to be approved by the ETA (or on their behalf). This strategy should allow companies full flexibility in the profiles they assign year on year and also maintain parity of esteem between ETA Certificated individuals from across the Sector. Preparing for an external examination should also be an effective motivating factor for encouraging self-managed learning at the higher levels.

(Annexes 1 to 5 overview the whole process diagrammatically)

### ***9. Relationship to Existing Professional Qualifications***

A clear driver for this initiative is the requirement of companies to develop schemes which meet the needs of the Engineering Institutions and the Engineering Council. A commonly reported requirement across the Sector, for example, is to adjust the overall balance away from Chartered Engineers and towards Incorporated Engineers for operational roles.

Therefore, it is important that the Initial Professional Development (IPD) policy makers in the Institutions, are invited to comment on the proposed approach, and to endorse the concept of ETA-developed templates, for Chartered, Incorporated and Engineering Technical Development schemes based on the Engineering Skills and Qualification Framework.

Since the approach proposed is completely in line with the SARTOR published approach for Initial Professional Development, it is to be expected that such support and endorsement will be forthcoming.

### ***10. Risks and Issues***

The sheer number of initiatives over the last decade relating to competencies, assessment and qualifications has led to a general negative bias and belief that associated bureaucracy swamps potential gains. Consequently, for an ETA Framework for Skills and Qualifications to be successful and gain acceptance by users it must be very evident that it is straightforward, simple to use and robust.

The underlying benefit most interested parties are seeking appears to be the avoidance of developing individual solutions to what are clearly common skills and training related requirements. e.g. Incorporated Engineer development schemes.

This means that any proposal must be likely to meet with a broad general consensus. This in turn suggests the elimination (at least in the first instance) of any features which could be considered too radical or difficult to achieve.

Unfortunately, to facilitate the development of large numbers of people and reliably and rigorously monitor and assess their progress, there is an inevitable requirement to record large quantities of data, information and related knowledge.

Managing this without attracting criticism of creating spurious bureaucracy will be a major challenge. Certainly every effort must be taken to harness up to date information technology techniques. Even allowing for the concept of flexible profiles and qualification definitions using modular Roles the proposal still has at least twelve different major Framework categories (4 levels each, against Generation, Transmission and Distribution). This will inevitably lead to a suggestion to combine Transmission and Distribution. However, although at first sight there are superficially similarities, Transmission and Distribution are fundamentally different in the type of activities they are engaged with - Obviously, Generation has a much wider diversity of fuel types and plant variation but the essential activities e.g. Mechanical, Electrical, C & I, Maintenance, have greater natural commonality across all types of Generation - differences mainly arising from plant type.

Nevertheless, developing a Skills Framework to cover the entire ESI Engineering functions and associated activities with just twelve category headings will be a significant challenge. To proliferate beyond this however, is to risk making the overall concept too unwieldy, and ultimately unmanageable.

## 11. *Suggested Way Forward*

1. Circulate Discussion Paper and Executive Summary widely and canvass comment on overall concept and proposed approach. Include related external parties such as IMech, IEE, IIE. - and offer an ETA hosted workshop.
2. In the light of comment refine the proposal to produce a second draft which will meet the outline requirements (modified as necessary in response to feedback) and achieve a broad consensus.
3. Develop a first draft framework, including all twelve categories, by pulling together and structuring the large amount of material already in existence. (The current Modern Apprenticeship schemes should provide the bulk of material for the three lower categories)
4. Commission subject experts/working groups for each of the framework headings to develop the draft into a comprehensive second draft.
5. Circulate second draft for comment/working group approval.
6. Develop, via consultation, Qualification content outlines.
7. Develop, via consultation, Qualification Assessment management and Quality Assurance procedures and guidelines.
8. Aim to have formative arrangements in place for registering candidates in Autumn 2000 (with major development of external summative assessment arrangements - i.e. ETA examinations and overall assessment Q/A - to follow for target June 2001 trials)

ETA 2/00

# ETA Engineering Skills Framework

## Generation

ETA Certified  
Generation Engineer II

ETA Certified  
Generation Engineer I

ETA Certified  
Generation Technician

ETA Certified  
Generation  
Craftsmen/Operator

## Transmission

ETA Certified  
Transmission Engineer II

ETA Certified  
Transmission Engineer I

ETA Certified  
Transmission Technician

ETA Certified  
Transmission Craftsman

## Distribution

ETA Certified  
Distribution Engineer II

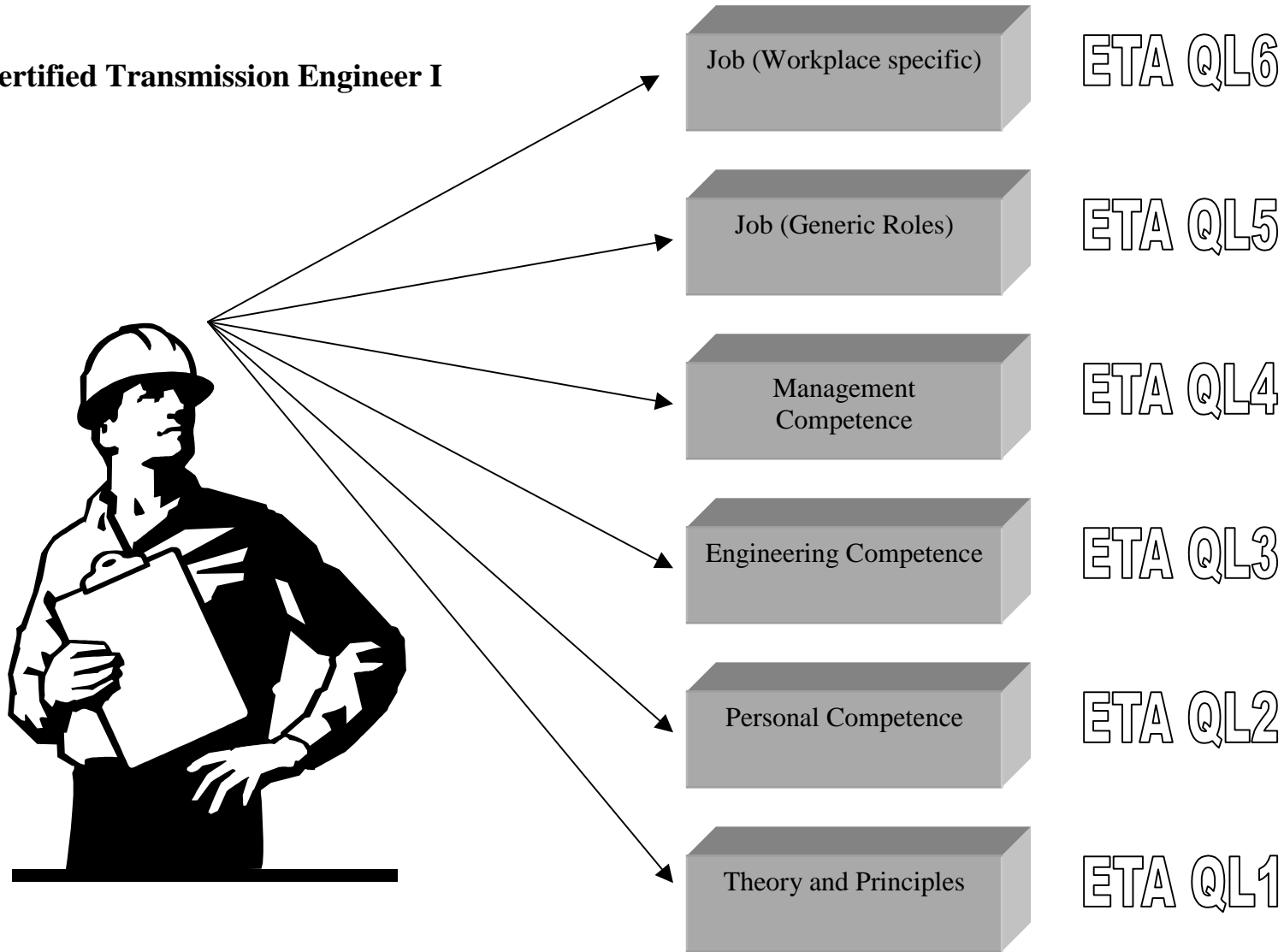
ETA Certified  
Distribution Engineer I

ETA Certified  
Distribution Technician

ETA Certified  
Distribution Craftsman

# ETA Engineering Skills Framework

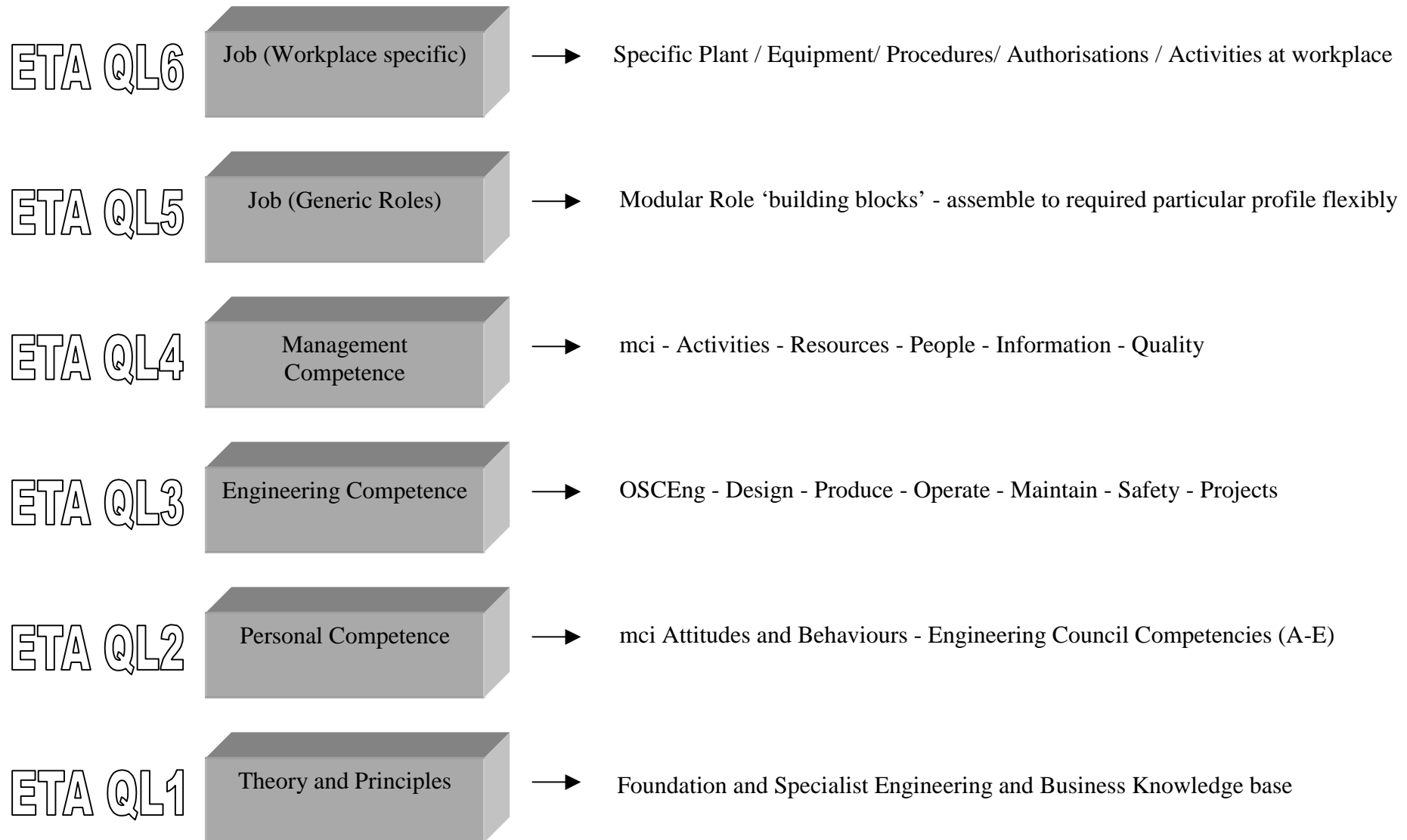
**ETA Certified Transmission Engineer I**



Annexe 2

# ETA Engineering Skills Framework

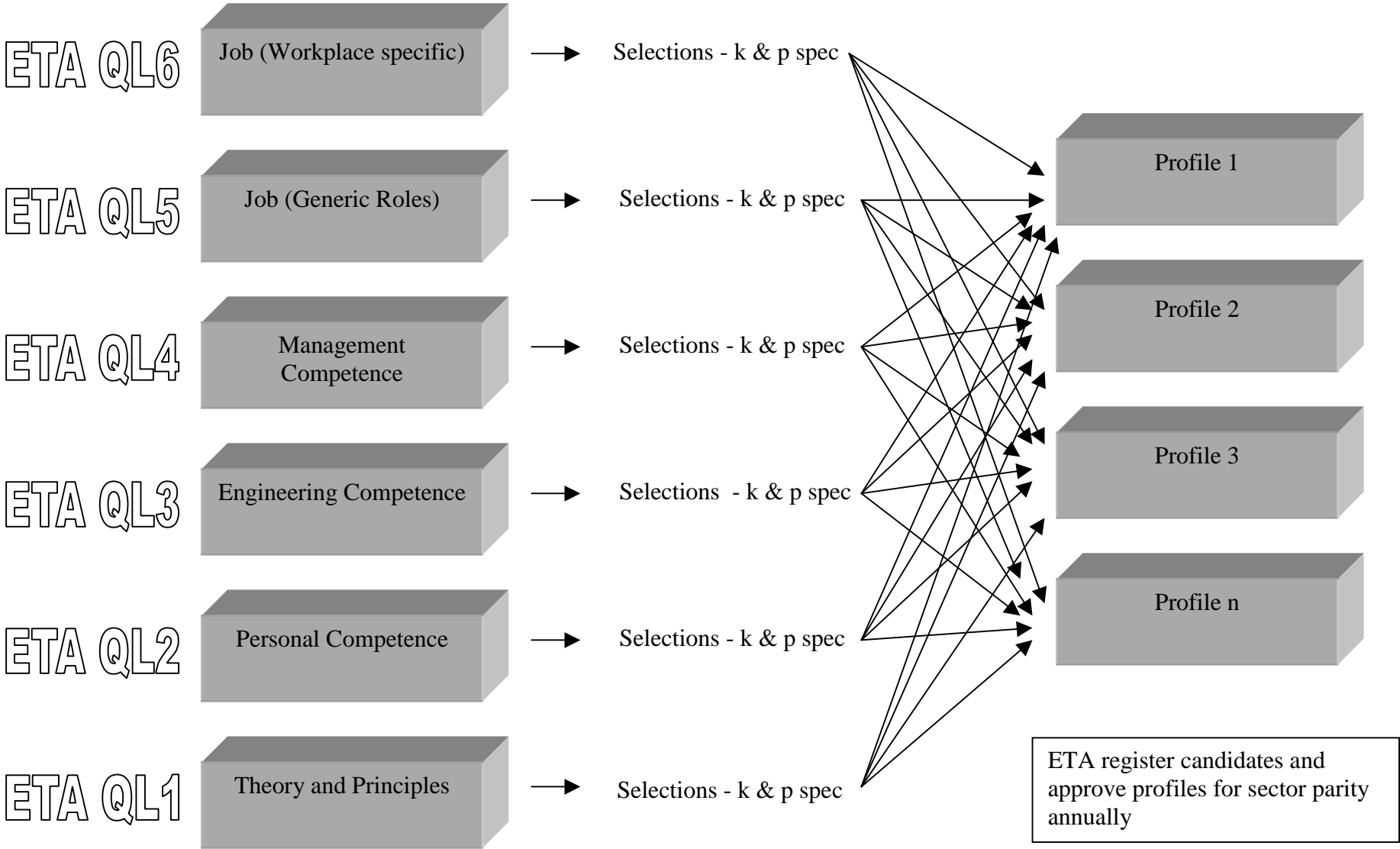
## ETA Certified Transmission Engineer I





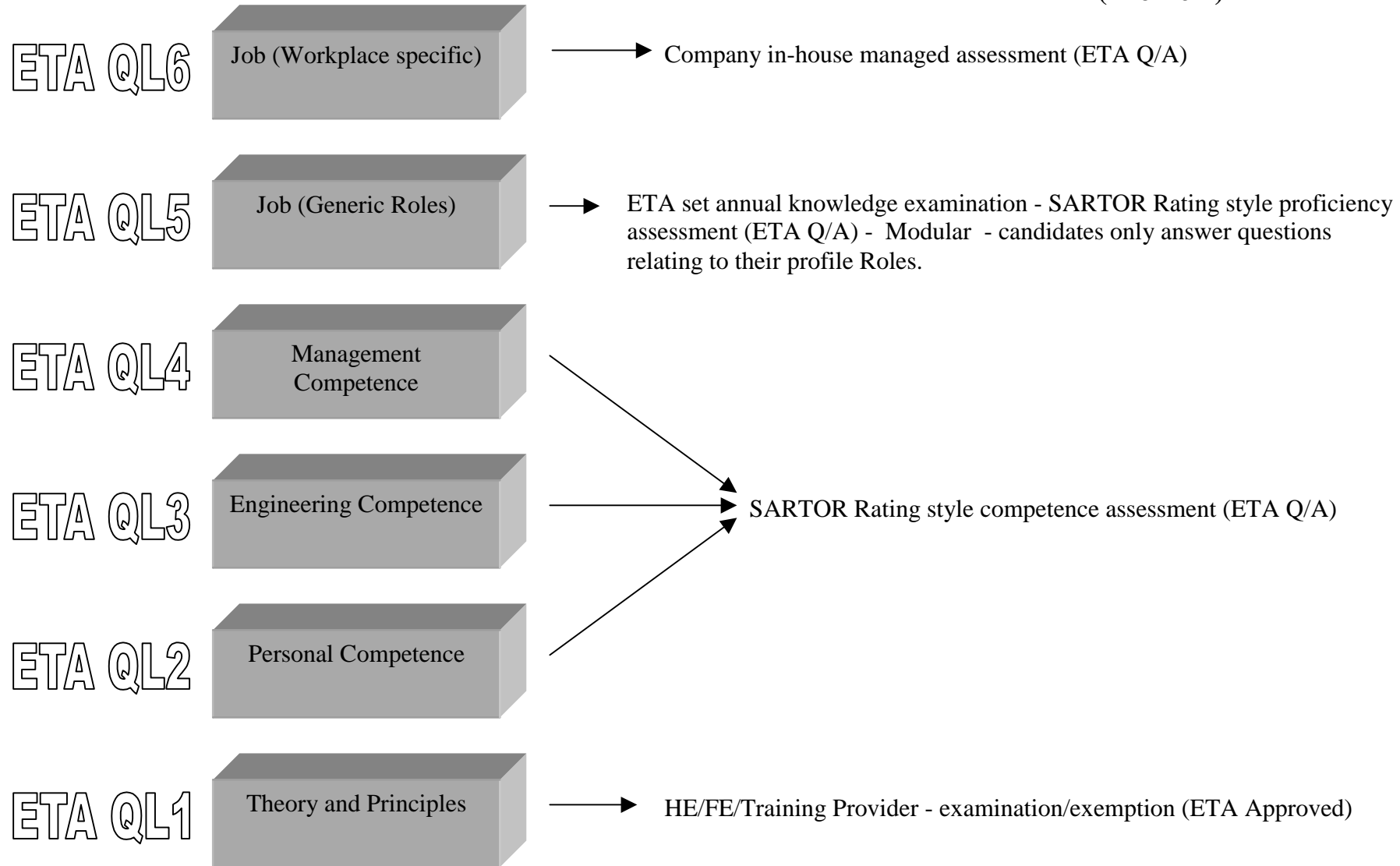
# ETA Engineering Skills Framework

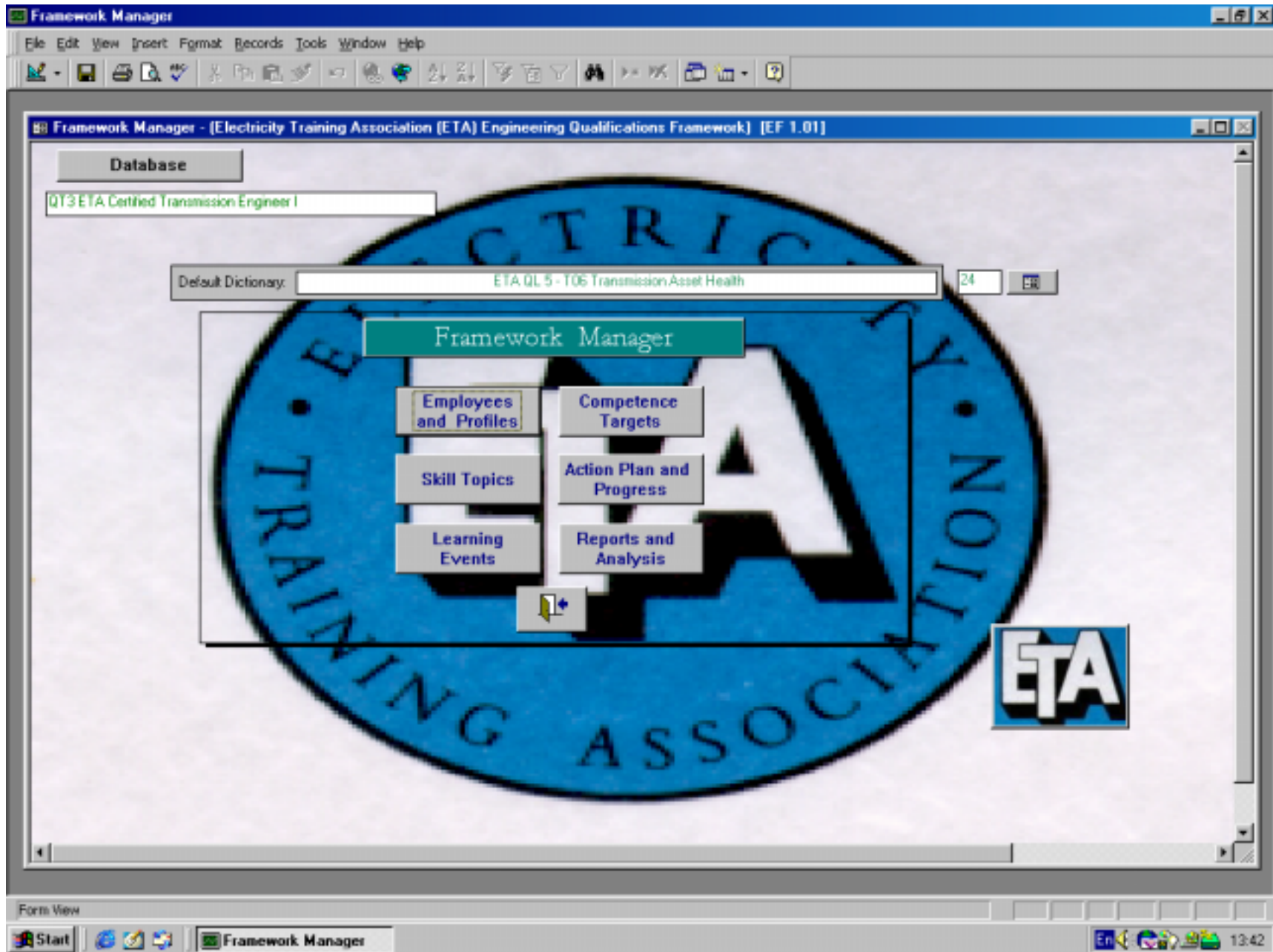
## ETA Certified Transmission Engineer I



# ETA Engineering Skills Framework

## ETA Certified Transmission Engineer I (Profile n)





Framework Manager

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Skill Topics

Select Dictionary: **ETA QL 5 - T06 Transmission Asset Health**

ETA QL 1 - External Qualifications Register 29

ETA QL 1 - Electronics Theory (Advanced) 36

ETA QL 1 - Engineering Maths (Intermediate) 39

ETA QL 1 - Mechanical Theory (Intermediate) 40

ETA QL 1 - SARTOR Matching Section 03 41

ETA QL 1 - SARTOR Matching Section 04 42

ETA QL 1 - T01 Power Systems Theory 15

ETA QL 1 - T08 Generation Overview 26

ETA QL 1 - T09 Distribution Overview 27

ETA QL 1 - T10 Electricity Supply Overview 28

ETA QL 1 - Telecommunications: Theory (Intermediate) 35

ETA QL 2 - mci Attitude and Behaviour clusters 43

ETA QL 2 - A. Use Knowledge & Understanding to Optimise 1

ETA QL 2 - B. Apply Theory & Methods to Problems 2

ETA QL 2 - C. Technical Commercial & Management Leadership 3

ETA QL 2 - D. Effective Communication & Interpersonal Skills 4

ETA QL 2 - E. Professional Conduct Code 5

ETA QL 3 - DSCEng Occupational Standards 13

ETA QL 4 - A Manage Activities 6

ETA QL 4 - B Manage Resources 7

ETA QL 4 - C Manage People 8

ETA QL 4 - D Manage Information 9

ETA QL 4 - F Manage Quality 10

ETA QL 4 - G Manage Projects 11

ETA QL 4 - H Manage Environmental Performance 12

ETA QL 5 - Health and Safety 37

ETA QL 5 - T02 Transmission System Design & Development 16

ETA QL 5 - T031 Transmission Technology (Circuits) 17

ETA QL 5 - T032 Transmission Technology (Substations) 18

ETA QL 5 - T033 Transmission Technology (Control & Telecommunications) 19

ETA QL 5 - T034 Transmission Technology (Protection & Measurement) 20

ETA QL 5 - T04 Transmission Procurement/Installation & Commissioning 21

ETA QL 5 - T051 Transmission Network Management (Operations) 22

ETA QL 5 - T052 Transmission Network Management (Support) 23

**ETA QL 5 - T06 Transmission Asset Health 24**

ETA QL 5 - T07 Transmission Business Commercial 25

ETA QL 6 - Grid Control 31

ETA QL 6 - Protection Equipment Commissioning 32

ETA QL 6 - Transmission Operations and Maintenance 33

ETA QL 6 - Transmission Protection (Operational Overview) 30

ETA QL 6 - Transmission Safety 34

Skill Topics

Skills by Dictionary or Group toggle:  Skills by Dictionary:

836

837

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851

838

852

857

862

867

872

877

882

887

839

853

Form View

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*Framework Category:* **QT4 ETA Certified Transmission Engineer II**

**Framework outline**

ETA QL 1 - External Qualifications Register  
ETA QL 1 - Electronics Theory (Advanced)  
ETA QL 1 - Engineering Maths (Intermediate)  
ETA QL 1 - Mechanical Theory (Intermediate)  
ETA QL 1 - SARTOR Matching Section 01  
ETA QL 1 - SARTOR Matching Section 02  
ETA QL 1 - T01 Power Systems Theory  
ETA QL 1 - T08 Generation Overview  
ETA QL 1 - T09 Distribution Overview  
ETA QL 1 - T10 Electricity Supply Overview  
ETA QL 1 - Telecommunications Theory (Intermediate)

ETA QL 2 - mci Attitude and Behaviour clusters  
ETA QL 2 - A. Use Knowledge & Understanding to Optimise  
ETA QL 2 - B. Apply Theory & Methods to Problems  
ETA QL 2 - C. Technical Commercial & Management Leadership  
ETA QL 2 - D. Effective Communication & Interpersonal Skills  
ETA QL 2 - E. Professional Conduct Code

ETA QL 3 - OSCEng Occupational Standards

ETA QL 4 - A Manage Activities  
ETA QL 4 - B Manage Resources  
ETA QL 4 - C Manage People  
ETA QL 4 - D Manage Information  
ETA QL 4 - F Manage Quality  
ETA QL 4 - G Manage Projects  
ETA QL 4 - H Manage Environmental Performance

ETA QL 5 - Health and Safety  
ETA QL 5 - T02 Transmission System Design & Development  
ETA QL 5 - T031 Transmission Technology (Circuits)  
ETA QL 5 - T032 Transmission Technology (Substations)  
ETA QL 5 - T033 Transmission Technology (Control & Telecommunications)  
ETA QL 5 - T034 Transmission Technology (Protection & Measurement)  
ETA QL 5 - T04 Transmission Procurement/Installation & Commissioning  
ETA QL 5 - T051 Transmission Network Management (Operations)  
ETA QL 5 - T052 Transmission Network Management (Support)  
ETA QL 5 - T06 Transmission Asset Health  
ETA QL 5 - T07 Transmission Business Commercial

ETA QL 6 - Grid Control Engineer  
ETA QL 6 - Protection Equipment Commissioning  
ETA QL 6 - Transmission Operations and Maintenance  
ETA QL 6 - Transmission Protection (Operational Overview)  
ETA QL 6 - Transmission Safety

## *Framework Category: QT3 ETA Certified Transmission Engineer I*

### **Framework outline**

ETA QL 1 - External Qualifications Register  
ETA QL 1 - Electronics Theory (Advanced)  
ETA QL 1 - Engineering Maths (Intermediate)  
ETA QL 1 - Mechanical Theory (Intermediate)  
ETA QL 1 - SARTOR Matching Section 03  
ETA QL 1 - SARTOR Matching Section 04  
ETA QL 1 - T01 Power Systems Theory  
ETA QL 1 - T08 Generation Overview  
ETA QL 1 - T09 Distribution Overview  
ETA QL 1 - T10 Electricity Supply Overview  
ETA QL 1 - Telecommunications Theory (Intermediate)

ETA QL 2 - mci Attitude and Behaviour clusters  
ETA QL 2 - A. Use Knowledge & Understanding to Optimise  
ETA QL 2 - B. Apply Theory & Methods to Problems  
ETA QL 2 - C. Technical Commercial & Management Leadership  
ETA QL 2 - D. Effective Communication & Interpersonal Skills  
ETA QL 2 - E. Professional Conduct Code

ETA QL 3 - OSCEng Occupational Standards

ETA QL 4 - A Manage Activities  
ETA QL 4 - B Manage Resources  
ETA QL 4 - C Manage People  
ETA QL 4 - D Manage Information  
ETA QL 4 - F Manage Quality  
ETA QL 4 - G Manage Projects  
ETA QL 4 - H Manage Environmental Performance

ETA QL 5 - Health and Safety  
ETA QL 5 - T02 Transmission System Design & Development  
ETA QL 5 - T031 Transmission Technology (Circuits)  
ETA QL 5 - T032 Transmission Technology (Substations)  
ETA QL 5 - T033 Transmission Technology (Control & Telecommunications)  
ETA QL 5 - T034 Transmission Technology (Protection & Measurement)  
ETA QL 5 - T04 Transmission Procurement/Installation & Commissioning  
ETA QL 5 - T051 Transmission Network Management (Operations)  
ETA QL 5 - T052 Transmission Network Management (Support)  
ETA QL 5 - T06 Transmission Asset Health  
ETA QL 5 - T07 Transmission Business Commercial

ETA QL 6 - Grid Control  
ETA QL 6 - Protection Equipment Commissioning  
ETA QL 6 - Transmission Operations and Maintenance  
ETA QL 6 - Transmission Protection (Operational Overview)  
ETA QL 6 - Transmission Safety

## *Framework Category: QT2 ETA Certified Transmission Technician*

### **Framework outline**

ETA QL 1 - Power Theory (Basic)

ETA QL 2 - mci Attitude and Behaviour clusters

ETA QL 2 - A. Use Knowledge & Understanding to Optimise

ETA QL 2 - B. Apply Theory & Methods to Problems

ETA QL 2 - C. Technical Commercial & Management Leadership

ETA QL 2 - D. Effective Communication & Interpersonal Skills

ETA QL 2 - E. Professional Conduct Code

ETA QL 3 - ETA Distribution and Transmission NVQ 3

ETA QL 3 - OSCEng Occupational Standards

ETA QL 4 - A Manage Activities

ETA QL 4 - B Manage Resources

ETA QL 4 - C Manage People

ETA QL 4 - D Manage Information

ETA QL 4 - F Manage Quality

ETA QL 4 - G Manage Projects

ETA QL 5 - TC01 - Planning and Organisation

ETA QL 5 - TC02 - SAP Basic

ETA QL 5 - TC03 - Company Awareness

ETA QL 5 - TC04 - Managing Safety

ETA QL 5 - TC05 - IT Awareness

ETA QL 5 - TC06 - Generic Skills

ETA QL 5 - TT01 - OHL Engineering Techniques

ETA QL 5 - TT02 - Main Plant Engineering Techniques

ETA QL 5 - TT03A - Protection Engineering Techniques

ETA QL 5 - TT03B - Telecomms Engineering Techniques

ETA QL 5 - TT04 - Main Plant Engineering Awareness

ETA QL 5 - TT05 - OHL Engineering Awareness

ETA QL 5 - TT06 - Light Current Engineering Awareness

ETA QL 6 - A. Transmission Asset Health

ETA QL 6 - B. Transmssion Substations maintenance detail

ETA QL 6 - C. Transmission Overhead Line maintenance detail

ETA QL 6 - D. Transmission Plant maintenance detail

ETA QL 6 - F. Transmission Protection Relays maintenance detail

ETA QL 6 - G. Transmission Safety detail

ETA QL 6 - H. Transmission Protection Maintenance detail

ETA QL 6 - I. Transmssion Telecomms Maintenance detail

*Framework Category:* **QT1 ETA Certified Transmission Craftsman**

**Framework outline**

ETA QL 1 - City and Guilds 232 Craft Electrical Principles

ETA QL 2 - mci Attitude and Behaviour clusters

ETA QL 2 - A. Use Knowledge & Understanding to Optimise

ETA QL 2 - B. Apply Theory & Methods to Problems

ETA QL 2 - C. Technical Commercial & Management Leadership

ETA QL 2 - D. Effective Communication & Interpersonal Skills

ETA QL 2 - E. Professional Conduct Code

ETA QL 3 - ETA Distribution and Transmission NVQ 3

ETA QL 4 - Frontline Management

ETA QL 5 - A. FTMA - Common Foundation

ETA QL 5 - B. FTMA - Common Skills

ETA QL 5 - C. FTMA - Common Specialist Skills

ETA QL 5 - D. FTOHL - Foundation Skills

ETA QL 5 - E. FTOHL - Common Skills

ETA QL 5 - F. FTOHL - Specialist Skills

ETA QL 5 - G. FTSS - Foundation Skills

ETA QL 5 - H. FTSS - Common Skills

ETA QL 5 - I. FTSS - Specialist Skills

ETA QL 6 - A. Transmission Asset Health

ETA QL 6 - B. Transmission Substations maintenance detail

ETA QL 6 - C. Transmission Overhead Line maintenance detail

ETA QL 6 - D. Transmission Plant maintenance detail

ETA QL 6 - G. Transmission Safety detail



## *Annexe 10*

*Samples are shown here from all levels (ETA QL1 - ETA QL6)  
at the content grouping level.*

*This level would be appropriate for qualification high level  
content/assessment definition, skills auditing and monitoring.*

*Annexe 11 shows samples of the next level of content detail.*

## *Framework category (content groupings)*

### *Framework Category (groupings) QT3 ETA Certified Transmission Engineer I*

#### ***ETA QL 1 - External Qualifications Register***

##### *\_Qualifications*

1. Secondary School
2. Further Education
3. Higher Education
4. Professional Qualifications

#### ***ETA QL 1 - Electronics Theory (Advanced)***

##### *\_Electronics Theory (Advanced)*

1. Energy bands in solids
2. Transport phenomena in semiconductors
3. Junction-diode characteristics
4. Diode circuits
5. Transistor characteristics
6. Digital circuits
7. Integrated circuits: Fabrication and characteristics
8. The transistor at low frequencies
9. Transistor biasing and thermal stabilisation
10. Field effect transistors
11. The transistor at high frequencies
12. Multistage amplifiers
13. Feedback amplifiers
14. Stability and oscillators
15. Operational amplifiers
16. Integrated circuits as analog system building blocks
17. Integrated circuits as digital system building blocks
17. Power circuits and systems
19. Semiconductor-device physics

#### ***ETA QL 1 - Engineering Maths (Intermediate)***

##### *\_Engineering Maths (Intermediate)*

1. Complex numbers, complex variables, transformations
2. Determinants
3. Elementary matrices
4. Differential equations
5. Integration, multiple integrals, beta and gamma functions
6. Partial differential equations
7. Fourier analysis and numerical harmonic analysis
8. Numerical methods and evaluations
9. The Laplace transform
10. Series, polynomials, power series expansion, Leibnitz theorem
11. Statistics and elementary quality control
12. Vectors, vector analysis

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 1 - Mechanical Theory (Intermediate)***

*\_Mechanical Theory (Intermediate)*

1. Statics
2. Frameworks
3. Friction
4. Velocity and acceleration
5. Inertia and change of motion
6. Motion in a circle
7. Stability and overturning
8. Balancing
9. Periodic motion
10. Dynamics of rotation
11. Work and energy
12. Impulse and momentum
13. Direct stress and strain
14. Properties of materials
15. Shear and torsion
16. Shear force and bending moment
17. Bending of beams
18. Combined bending and direct stress
19. Fluid at rest
20. Fluid in motion
21. Experimental errors and the adjustment of data

***ETA QL 1 - SARTOR Matching Section 03***

*\_ETA QL 1 - SARTOR Matching Section 03*

***ETA QL 1 - SARTOR Matching Section 04***

*\_ETA QL 1 - SARTOR Matching Section 03*

***ETA QL 1 - T01 Power Systems Theory***

*\_T01 Power Systems Theory*

1. General Background
2. Basic Concepts
31. Synchronous Machines
32. Lines, Cables and Transformers
4. Control of Power & Frequency
5. Control of Voltage and Reactive Power
6. Load Flows
7. Fault Analysis
8. System Stability
9. Direct Current Transmission
10. Overvoltages and Insulation Requirements
11. Substations and Protection
12. Basic Power System Economics

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 1 - T08 Generation Overview***

\_T08 Generation overview

1. Station planning and design
2. Boilers and ancillary plant
3. Turbines, generators and associated plant
4. Electrical systems and design
5. Chemistry and metallurgy
6. Control and instrumentation
7. Station commissioning
8. Station operation and maintenance
9. Nuclear Power Generation
10. CCGT and CHP Generation
11. Non-Fossil Fuel Generation

***ETA QL 1 - T09 Distribution Overview***

\_T09 Distribution Overview

1. Distribution System Design & Development
2. Distribution technology (Overhead Lines)
3. Distribution technology (Cables)
4. Distribution technology (Substations)
5. Distribution technology (Control & Telecommunications)
6. Distribution technology (Protection & Measurements)
7. Distribution Procurement/Installation & Commissioning
8. Distribution Network Management
9. Distribution Asset Health
10. Distribution Business Commercial

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 1 - T10 Electricity Supply Overview***

*\_T10 Electricity Supply Overview*

1. Electricity Supply Historic background
2. Electricity Industry structure in UK
3. Electricity Supply comparisons with other countries
4. Electricity Supply - Competition and the customer
5. Electricity Supply - Customer focus
6. Regulation
7. The Market rules
8. Electricity pool structure
9. Alternative Electricity Supply market structures
10. Pool settlements
11. Pooling and Settlement Agreement
12. The Pool experience 1990-2000
13. Energy trading function
14. Energy trading risks
15. Energy risk management methods
16. Managing risk - the generator perspective
17. Managing risk - the retailer perspective
18. Hedging instruments - types and uses
19. New Energy Trading Arrangements (NETA)
20. Electricity Supply - Economics background
21. Electricity and other energy markets
22. Electricity Supply - Financial appreciation
23. Electricity Supply - Human resources

***ETA QL 1 - Telecommunications Theory (Intermediate)***

*\_Telecommunications Theory (Intermediate)*

1. Origins and basic concepts
2. General telecommunications principles
3. Modulation and multiplexing
4. Analogue to digital conversion
5. Telephone networks
6. Data networks
7. Modems
8. Data communication techniques
9. Open Systems Interconnection (OSI)
10. X.25 packet-switched networks
11. Integrated Services Digital Networks
12. Local Area Networks (LANs)
13. Networking considerations
14. Fibre optic communications

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 2 - mci Attitude and Behaviour clusters***

\_ ETA QL 2 - mci Attitude and Behaviour clusters

1. Planning to optimise the achievement of results
2. Working with others to optimise results
3. Managing oneself to optimise results
4. Using intellect to optimise results

***ETA QL 2 - A. Use Knowledge & Understanding to Optimise***

\_A. Use Knowledge & Understanding to Optimise

- A.1 Maintain a sound theoretical approach
- A.2 Creative problem solving approach
- A.3 Exploit emerging technologies
- A.4 Promote innovation & technology transfer

***ETA QL 2 - B. Apply Theory & Methods to Problems***

\_B. Apply Theory & Methods to Problems

- B.1 Identify potential projects & opportunities
- B.2 Research, design and develop solutions
- B.3 Plan & implement solutions
- B.4 Evaluate solutions & make improvements

***ETA QL 2 - C. Technical Commercial & Management Leadership***

\_C. Technical, Commercial and Management Leadership

- C.1 Plan for project implementation
- C.2 Plan, budget, organise, direct & control
- C.3 Develop the capabilities of staff
- C.4 Bring about continuous improvement through quality

***ETA QL 2 - D. Effective Communication & Interpersonal Skills***

\_D. Effective Communication & Interpersonal Skills

- D.1 Communication & interpersonal skills
- D.2 Present & discuss ideas and plans
- D.3 Build teams and negotiate

***ETA QL 2 - E. Professional Conduct Code***

\_E. Professional Conduct Code

- E.1 Comply with professional codes & rules of conduct
- E.2 Manage and apply safe systems of work
- E.3 Comply with Codes of Practice ON Risk & Environment
- E.4 Carry out continuing professional development

***ETA QL 3 - OSCEng Occupational Standards***

*\_OSCEng Occupational Standards*

1. Develop engineering products/processes
2. Produce/procure engineering products/processes
3. Install engineering products/processes
4. Operate engineering products/processes
5. Maintain engineering products/processes
6. Improve the safety and quality of engineering products/processes
7. Plan and manage engineering projects
8. Develop own engineering competence

***ETA QL 4 - A Manage Activities***

*\_Manage Activities*

- A1 Maintain activities to meet requirements
- A2 Manage activities to meet requirements
- A3 Manage activities to meet customer requirements
- A4 Contribute to improvements at work
- A5 Manage change in organisational activities
- A6 Review external and internal operating environments
- A7 Establish strategies to guide the work of your organisation
- A8 Evaluate and improve organisational performance

***ETA QL 4 - B Manage Resources***

*\_Manage Resources*

- B1 Support the efficient use of resources
- B2 Manage the use of physical resources
- B3 Manage the use of financial resources
- B4 Determine the effective use of resources
- B5 Secure financial resources for your organisation's plans

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 4 - C Manage People***

*\_Manage People*

- C 1 Manage yourself
- C 2 Develop your own resources
- C 3 Enhance your own performance
- C 4 Create effective working relationships
- C 5 Develop productive working relationships
- C 6 Enhance productive working relationships
- C 7 Contribute to the selection of personnel for activities
- C 8 Select personnel for activities
- C 9 Contribute to the development of teams and individuals
- C10 Develop teams and individuals to enhance performance
- C11 Develop management teams
- C12 Lead the work of teams and individuals to achieve their objectives
- C13 Manage the performance of teams and individuals
- C14 Delegate work to others
- C15 Respond to poor performance in your team
- C16 Deal with poor performance in your teams
- C17 Redeploy personnel and make redundancies

***ETA QL 4 - D Manage Information***

*\_Manage Information*

- D1 Manage information for action
- D2 Facilitate meetings
- D3 Chair and participate in meetings
- D4 Provide information to support decision making
- D5 Establish information management and communication systems
- D6 Use information to take critical decisions

***ETA QL 4 - F Manage Quality***

*\_Manage Quality*

- F1 Promote the importance and benefits of quality
- F2 Provide advice and support for the development and implementation of quality policies
- F3 Manage continuous quality improvement
- F4 Implement quality assurance systems
- F5 Provide advice and support for the development and implementation of quality systems
- F6 Monitor compliance with quality systems
- F7 Carry out quality audits



*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 4 - G Manage Projects***

*\_Manage Projects*

- G1 Contribute to project planning and preparation
- G2 Co-ordinate the running of projects
- G3 Contribute to project closure
- G4 Plan and prepare projects
- G5 Manage the running of projects
- G6 Complete projects

***ETA QL 4 - H Manage Environmental Performance***

*\_Manage Environmental Performance*

- H 1 Evaluate environmental performance and recommend improvements
- H 2 Gain support and commitment for improving environmental performance
- H 3 Plan and implement activities to improve environmental performance
- H 4 Contribute to improving environmental performance during work activities
- H 5 Develop and maintain an environmental policy
- H 6 Evaluate, and make recommendations concerning, an environmental policy
- H 7 Plan, monitor and support auditing of environmental performance
- H 8 Audit environmental performance
- H 9 Report environmental performance to interested parties
- H10 Identify, implement and monitor action to improve environmental performance

***ETA QL 5 - Health and Safety***

*\_Health and Safety*

- 1. Health and safety management
- 2. Managing health and safety
- 3. Understanding why accidents occur
- 4. Common hazards
- 5. Hazard spotting
- 6. Risk assessment and risk management
- 7. Health and safety performance

***ETA QL 5 - T02 Transmission System Design & Development***

*\_T02 Transmission System Design & Development*

- 1. Commercial & Transmission Licence management
- 2. Planning & Standards
- 3. System Strategy & Design
- 4. New Connections
- 5. Technical Audit
- 6. NGC Commercial & System Design operating unit

**Framework Category (groupings) QT3 ETA Certified Transmission Engineer I**

***ETA QL 5 - T031 Transmission Technology (Circuits)***

\_T031 Transmission technology (Circuits)

1. 400/275kV Overhead Line technology
2. 132kV Overhead Line technology
3. EHV Cable technology

***ETA QL 5 - T032 Transmission Technology (Substations)***

\_T032 Transmission technology (Substations)

1. ABCB technology
2. SF6 CB technology
3. GIS technology
4. Disconnecter technology
5. Earth Switch technology
6. Substation ancillary equipment technology
7. Transformer technology
8. Transmission R&D and Specialist Engineering

***ETA QL 5 - T033 Transmission Technology (Control & Telecommunications)***

\_T033 Transmission technology (Control & Telecommunications)

1. Substation Control technology
2. Voice Telecomms technology
3. Data Telecomms technology
4. Intertripping technology

***ETA QL 5 - T034 Transmission Technology (Protection & Measurement)***

\_T034 Transmission technology (Protection & Measurement)

1. EHV Unit Protection technology
2. EHV Distance Protection technology
3. EHV Plant Protection technology
4. Generator Protection technology
5. Measurements technology
6. NGC T & S Organisation & Business management

***ETA QL 5 - T04 Transmission Procurement/Installation & Commissioning***

\_T04 Transmission Procurement/Installation & Commissioning

1. Transmission Projects commercial management
2. Transmission Circuits Projects
3. Transmission Plant Projects
4. Transmission Light Current Projects
5. Transmission Civil Projects
6. Transmission Projects - Application Design support
7. NGC Project Management current organisation & business management

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 5 - T051 Transmission Network Management (Operations)***

*\_T051 Transmission Network Management (Operations)*

1. Transmission System Production planning
2. Transmission System Network Operations
3. Generation Scheduling and Despatch
4. Transmission System Operation Safety Management
5. Transmission Services Scheme operation

***ETA QL 5 - T052 Transmission Network Management (Support)***

*\_T052 Transmission Network Management*

1. Transmission System Management Facilities
2. Transmission System Management Control technology
3. Transmission System Operational Review
4. NGC Network Management current organisation & business management

***ETA QL 5 - T06 Transmission Asset Health***

*\_T06 Transmission Asset Health*

1. EHV OHL Monitoring and Maintenance
2. EHV Cables Monitoring and Maintenance
3. EHV Plant Monitoring and Maintenance
4. EHV Protection Monitoring and Maintenance
5. EHV Substation Control Monitoring and Maintenance
6. EHV Telecomms Monitoring and Maintenance
7. NGC Network Services current organisation & business management

***ETA QL 5 - T07 Transmission Business Commercial***

*\_T07 Transmission Business Commercial*

1. Plc structure and management
2. Shareholders
3. Customers
4. External Stakeholders
5. Regulation
6. Corporate Strategy
7. International
8. Contracting
9. Research & Development

*Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

***ETA QL 6 - Grid Control***

*\_Grid Control*

1. Operational Requirements
2. Operational Requirements/Documentation
3. Operational Structures
4. Demand Characteristics
5. Power & Frequency Control
6. Voltage & Reactive Power Control
7. Generation Scheduling and Despatch
8. Liaison with Generators
9. Grid Control Instructions
10. Restructuring Contracts
11. Reserve Policy
12. Safety
13. Protection
14. Unplanned Outages
15. System Emergencies
16. Site Procedures and Emergency
17. Load Shedding
18. Other Contracts
19. Black Start
20. Alarm Management
21. Argus
22. England & Wales Pool
23. Communication Systems
24. Administration

***ETA QL 6 - Protection Equipment Commissioning***

*\_Protection Equipment Commissioning*

1. Commissioning Attitude and Philosophy
2. Commissioning Responsibilities
3. Commissioning Project Management
4. Company Commissioning Documentation
5. Safe Working
6. Avoidance of Error techniques
7. Schematic and Wiring Diagrams
8. Factory Acceptance Process
9. Test Instruments and Test Supplies
10. Testing Procedures
11. Planning Tests
12. Pre-Commissioning Tests
13. On-Load Tests
14. Protection and Control Schemes

## *Framework Category (groupings)* **QT3 ETA Certified Transmission Engineer I**

### ***ETA QL 6 - Transmission Operations and Maintenance***

#### *\_Transmission Operations and Maintenance*

1. Primary plant maintenance supervision and commissioning - ABCBs
2. Primary plant maintenance supervision and commissioning - OCBs
3. Primary plant maintenance supervision and commissioning - other CBs
4. Primary plant maintenance supervision and commissioning - other plant
5. Primary plant maintenance supervision and commissioning - tapchangers
6. Primary plant maintenance supervision and commissioning SF6 CB
7. OH lines maintenance and construction
8. Line and cable route inspections
9. Protection and control systems - maintenance, testing and commissioning
10. Site inspections
11. Substation skills

### ***ETA QL 6 - Transmission Protection (Operational Overview)***

#### *\_Transmission Protection (Operational Overview)*

1. Definitions
2. Protection application and CB tripping policy
3. Protection Systems
4. Overcurrent Protection
5. Earth fault Protection
6. Feeder Protection
7. Transformer Protection
8. Transformer overfluxing
9. Bus bar protection
10. Circuit Breaker fail protection
11. Generator Protection
12. Tripping of remote circuit breakers
13. Protection signalling facilities
14. Switchgear
14. Types of protection signalling equipment
15. Control and Alarm facilities
15. Switching problems on Transformer feeders
16. Automatic Control
16. High Voltage cable cooling
17. Site auxiliary supplies
18. Company Documentation

### ***ETA QL 6 - Transmission Safety***

#### *\_Transmission Safety*

1. General safety codes of practice
2. Safety and safety related
3. HSE approved codes of practice
4. Mandatory skills

## *Annexe 11*

*Samples are shown here from all levels (ETA QL1 - ETA QL6)  
at the detailed content level.*

*This level would be appropriate for detailed qualification syllabus definition and supporting training material design specification. The Framework Manger CD supports moving from this level to include subject notes and diagrams etc - effectively enabling the building of sets of learner support modules.*

**ETA QL 1 - T01 Power Systems Theory**

Group ***\_T01 Power Systems Theory***

*\_T01 Power Systems Theory*

Group ***1. General Background***

*\_1. General Background*

Group ***2. Basic Concepts***

*\_2. Basic Concepts*

1. Three Phase Systems
2. Three Phase Transformers
3. Harmonics in Three Phase Systems
4. Multiphase Systems
5. Reactive Power
6. The Per-Unit System
7. Power Transfer and Reactive Power
8. Basic Network Theory

Group ***31. Synchronous Machines***

*\_31. Synchronous Machines*

2. Balanced Short Circuit analysis
3. Synchronous Generators in parallel
4. Generator Operation on Infinite Bus
5. Synchronous Machine Characteristics
6. Salient Pole Generators
7. Automatic Voltage Regulators

Group ***32. Lines, Cables and Transformers***

*\_32. Lines, Cables and Transformers*

2. Overhead Line types and parameters
3. Representation of Lines
4. Parameters of Underground Cables
5. Transformers
6. Connection of Three Phase Transformers
7. Voltage Characteristics of Loads

Group ***4. Control of Power & Frequency***

*\_4. Control of Power & Frequency*

2. The Turbine Governor
3. Control Loops
4. Division of Load between Generators
5. Interconnected Systems Power/Frequency characteristics
6. Small Capacity Line System Interconnection
7. Economic Power System Operation
8. Computer control of Load & Frequency

***ETA QL 2 - B. Apply Theory & Methods to Problems***

Group    ***\_B. Apply Theory & Methods to Problems***

\_ B. Apply Theory & Methods to Problems

Group    ***B.1 Identify potential projects & opportunities***

\_B.1 Identify potential projects & opportunities

B.1.1 Review external developments & assess applicability

B.1.2 Continually review potential for enhancement to products & services

B.1.3 Identify the complexities of potential projects and problems

B.1.4 Exercise original thought in meeting engineering challenges

B.1.5 Use knowledge of organisation's commercial position to assess project viability

Group    ***B.2 Research, design and develop solutions***

\_B.2 Research, design and develop solutions

B.2.1 Demonstrate potential solutions using analytical models and tools

B.2.2 Analyse concepts & designs for performance, reliability & maintainability etc

B.2.3 Undertake cost-benefit & risk analyses etc to produce a workable design

B.2.4 Use appropriate engineering and technological aids

Group    ***B.3 Plan & implement solutions***

\_B.3 Plan & implement solutions

B.3.1 Prepare & recommend documented proposals

B.3.2 Manage testing process and analyse results

B.3.3 Anticipate possible problem areas and manage any required modifications

B.3.4 Take corrective action to overcome any revealed shortcomings

Group    ***B.4 Evaluate solutions & make improvements***

\_B.4 Evaluate solutions & make improvements

B.4.1 Determine impact on design of life-cycle implications & logistic support

B.4.2 Participate in consultations on product or process evaluations

B.4.3 Evaluate solutions against specification

B.4.4 Identify and implement required practicable improvements



***ETA QL 3 - OSCEng Occupational Standards***

Group    ***\_OSCEng Occupational Standards***

\_\_OSCEng Occupational Standards

Group    ***1. Develop engineering products/processes***

  \_1. Develop engineering products/processes

  1.1.1. Identify the requirements of clients for engineering products/processes

  1.1.2. Produce specifications for engineering products/processes

  1.2.1. Identify and define areas of research

  1.2.2. Develop a research methodology

  1.2.3. Propose research into engineering products/processes

  1.3.1. Research into engineering products/processes

  1.3.2. Evaluate results of research

  1.4.1. Develop a strategy for the design process

  1.4.2. Establish a design brief for engineering products/processes

  1.4.3. Create designs for engineering products/processes

  1.4.4. Evaluate designs for engineering products/processes

Group    ***2. Produce/procure engineering products/processes***

  \_2. Produce engineering products/processes

  2.1.1. Determine the production requirements of engineering products/processes

  2.1.2. Specify production methods and procedures to achieve production requirements

  2.1.3. Obtain the resources to implement the production methods and procedures

  2.1.4. Schedule production activities to implement the production

  2.2.1. Implement production methods and procedures

  2.2.2. Resolve production problems with engineering solutions

  2.3.1. Monitor the production process

  2.3.2. Evaluate the production process

Group    ***3. Install engineering products/processes***

  \_3. Install engineering products/processes

  3.1.1. Determine the installation requirements of engineering products/processes

  3.1.2. Specify installation methods and procedures to achieve installation requirements

  3.1.3. Obtain the resources to implement the installation methods and procedures

  3.1.4. Schedule installation activities to implement the installation methods and procedures

  3.2.1. Implement installation methods and procedures

  3.2.2. Resolve installation problems with engineering solutions

  3.3.1. Monitor the installation process

  3.3.2. Evaluate the installation process

  3.4.1. Configure engineering products/processes to meet requirements

  3.4.2. Commission engineering products/processes

  3.4.3. Transfer control of the engineering products/processes

Group    ***4. Operate engineering products/processes***

  \_4. Operate engineering products or processes

  4.1.1 Determine the operational requirements of engineering products/processes

*Framework Category (detail):*    **QT3 ETA Certified Transmission Engineer I**

- 4.1.2 Specify operational methods and procedures to achieve operational requirements
- 4.1.3 Schedule operational methods and procedures to achieve operational requirements
- 4.1.4 Obtain the resources to implement the operational methods and procedures
- 4.2.1 Implement operational methods and procedures
- 4.2.2 Solve operational problems with engineering solutions
- 4.3.1 Monitor operational processes
- 4.3.2 Evaluate operational processes
- 4.4.1 Propose engineering products/processes for decommissioning
- 4.4.2 Implement decommissioning methods and procedures

**Group    5. *Maintain engineering products/processes***

- \_5. Maintain engineering products/processes
- 5.1.1. Determine the maintenance requirements of engineering products/processes
- 5.1.2. Specify maintenance methods and procedures to achieve maintenance requirements
- 5.1.3. Schedule maintenance activities to implement the maintenance methods and procedures
- 5.1.4. Obtain the resources to implement the maintenance methods and procedures
- 5.2.1. Implement maintenance methods and procedures
- 5.2.2. Solve maintenance problems with engineering solutions
- 5.3.1. Monitor the maintenance process
- 5.3.2. Evaluate the maintenance process

**Group    6. *Improve the safety and quality of engineering products/processes***

- \_6. Improve the safety and quality of engineering products/processes
- 6.1.1. Analyse the risks arising from engineering products/processes and processes
- 6.1.2. Specify methods and procedures to reduce risks
- 6.1.3. Investigate incidents relating to engineering products/processes
- 6.2.1. Assure the quality of engineering products/processes
- 6.2.2. Identify the reasons for quality assurance problems
- 6.2.3. Implement improvements to the quality of engineering products/processes

**Group    7. *Plan and manage engineering projects***

- \_7. Plan and manage engineering projects
- 7.1.1. Develop objectives for projects
- 7.1.2. Plan the delivery of projects
- 7.1.3. Obtain the resources required to achieve project objectives
- 7.1.4. Specify the engineering activities required to achieve project objectives
- 7.2.1. Establish project management systems
- 7.2.2. Manage the implementation of projects
- 7.2.3. Evaluate projects

**Group    8. *Develop own engineering competence***

- \_8. Develop own engineering expertise
- 8.1.1. Maintain and develop engineering expertise
- 8.1.2. Apply professional ethics and values

**ETA QL 4 - C Manage People**

Group ***\_Manage People***

*\_Manage People*

Group ***C 1 Manage yourself***

*\_C1 Manage yourself*

C.1 Develop your own skills to improve your performance

C1.2 Manage your time to meet your objectives

Group ***C 2 Develop your own resources***

*\_C2 Develop your own resources*

C2.1 Develop yourself to improve your performance

C2.2 Manage your own time and resources to meet your objectives

Group ***C 3 Enhance your own performance***

*\_C3 Enhance your own performance*

C3.1 Continuously develop your own knowledge and skills

C3.2 Optimise your own resources to meet your objectives

Group ***C 4 Create effective working relationships***

*\_C4 Create effective working relationships*

C4.1 Gain the trust and support of colleagues and team members

C4.2 Gain the trust and support of your manager

C4.3 Minimise conflict in your team

Group ***C 5 Develop productive working relationships***

*\_C5 Develop productive working relationships*

C5.1 Develop the trust and support of colleagues and team members

C5.2 Develop the trust and support of your manager

C5.3 Minimise interpersonal conflict

Group ***C 6 Enhance productive working relationships***

*\_C6 Enhance productive working relationships*

C6.1 Enhance the trust and support of colleagues

C6.2 Enhance the trust and support of those to whom you report

C6.3 Provide guidance on values at work

Group ***C 7 Contribute to the selection of personnel for activities***

*\_C7 Contribute to the selection of personnel for activities*

C7.1 Contribute to identifying personnel requirements

C7.2 Contribute to selecting required personnel

Group ***C 8 Select personnel for activities***

*\_C8 Select personnel for activities*

C8.1 Identify personnel requirements

C8.2 Select required personnel

***ETA QL 5 - T032 Transmission Technology (Substations)***

Group    ***\_T032 Transmission technology (Substations)***

*\_T032 Transmission technology (Substations)*

Group    ***1. ABCB technology***

*\_1. ABCB technology*

1. ABCBs - Application requirements and technology principles
2. ABCBs - Installed base and performance experience
3. ABCBs - Application Design
4. ABCBs - Technology operational support
5. ABCBs - Emerging technology

Group    ***2. SF6 CB technology***

*\_2. SF6 CB technology*

1. SF6 CBs - Application requirements and technology principles
2. SF6 CBs - Installed base and performance experience
3. SF6 CBs - Application Design
4. SF6 CBs - Technology operational support
5. SF6 CBs - Emerging technology

Group    ***3. GIS technology***

*\_3. GIS technology*

1. GIS - Application requirements and technology principles
2. GIS - Installed base and performance experience
3. GIS - Application Design
4. GIS - Technology operational support
5. GIS - Emerging technology

Group    ***4. Disconnecter technology***

*\_4. Disconnecter technology*

1. Disconnectors - Application requirements and technology principles
2. Disconnectors - Installed base and performance experience
3. Disconnectors - Application Design
4. Disconnectors - Technology operational support
5. Disconnectors - Emerging technology

Group    ***5. Earth Switch technology***

*\_5. Earth Switch technology*

1. Earth Switches - Application requirements and technology principles
2. Earth Switches - Installed base and performance experience
3. Earth Switches - Application Design
4. Earth Switches - Technology operational support
5. Earth Switches - Emerging technology

Group    ***6. Substation ancillary equipment technology***

*\_6. Substation ancillary equipment technology*

1. Substation ancillaries - Application requirements and technology principles

**ETA QL 5 - T06 Transmission Asset Health**

Group ***\_T06 Transmission Asset Health***

*\_T06 Transmission Asset Health*

Group ***1. EHV OHL Monitoring and Maintenance***

*\_1. EHV OHL Monitoring and Maintenance*

1. EHV OHL - Determine maintenance requirements
2. EHV OHL - Specify maintenance methods and procedures
3. EHV OHL - Schedule maintenance activities
4. EHV OHL - Obtain resources for maintenance activities
5. EHV OHL - Implement operational methods and procedures
6. EHV OHL - Solve maintenance problems with engineering solutions
7. EHV OHL - Monitor the maintenance process
8. EHV OHL - Evaluate the maintenance process

Group ***2. EHV Cables Monitoring and Maintenance***

*\_2. EHV Cables Monitoring and Maintenance*

1. EHV Cables - Determine maintenance requirements
2. EHV Cables - Specify maintenance methods and procedures
3. EHV Cables - Schedule maintenance activities
4. EHV Cables - Obtain resources for maintenance activities
5. EHV Cables - Implement operational methods and procedures
6. EHV Cables - Solve maintenance problems with engineering solutions
7. EHV Cables - Monitor the maintenance process
8. EHV Cables - Evaluate the maintenance process

Group ***3. EHV Plant Monitoring and Maintenance***

*\_3. EHV Plant Monitoring and Maintenance*

1. EHV Plant - Determine maintenance requirements
2. EHV Plant - Specify maintenance methods and procedures
3. EHV Plant - Schedule maintenance activities
4. EHV Plant - Obtain resources for maintenance activities
5. EHV Plant - Implement operational methods and procedures
6. EHV Plant - Solve maintenance problems with engineering solutions
7. EHV Plant - Monitor the maintenance process
8. EHV Plant - Evaluate the maintenance process

Group ***4. EHV Protection Monitoring and Maintenance***

*\_4. EHV Protection Monitoring and Maintenance*

1. EHV Protection - Determine maintenance requirements
2. EHV Protection - Specify maintenance methods and procedures
3. EHV Protection - Schedule maintenance activities
4. EHV Protection - Obtain resources for maintenance activities
5. EHV Protection - Implement operational methods and procedures
6. EHV Protection - Solve maintenance problems with engineering solutions
7. EHV Protection - Monitor the maintenance process

***ETA QL 6 - Protection Equipment Commissioning***

Group    ***\_Protection Equipment Commissioning***

\_\_Protection Equipment Commissioning

Group    ***1. Commissioning Attitude and Philosophy***

\_Commissioning Attitude and Philosophy

Attention to Detail

Constructively critical and non-complacent approach

Continuous overall project awareness / involvement

Detailed Record Keeping

Final Checks

Group    ***2. Commissioning Responsibilities***

\_Commissioning Responsibilities

Commissioning Engineer Role

Commissioning Officer Role

Commissioning Panel

Commissioning Panel Chairman

Contractor Representative(s) Role

System Control Engineer Role

Witnessing Role

Group    ***3. Commissioning Project Management***

\_Commissioning Project Management

Establish identities and roles (e.g competent persons, SAP's)

Plan/schedule and implement appropriate meetings

Produce Commissioning Project Gantt/Bar chart

Group    ***4. Company Commissioning Documentation***

\_Company Commissioning Documentation

Contractors Commissioning Procedures and pro-formas

Equipment Manuals/Data/Instructions

Manufacturers Commissioning Procedures and pro-formas

Protection and Control, Design Standards

Site Drawings

Standard Commissioning Test pro-formas (SCT's)

Group    ***5. Safe Working***

\_Safe Working

Assess and agree Circuit Live / Dead working

Critically assess team member capabilities

CT shorting strategy

Ensure full compliance with relevant Safety Rules

Plan and manage equipment identification measures

Protection related Codes of Practice and guidance notes

Studying relevant drawings and supporting information

Group **13. On-Load Tests**

\_On-Load Tests

Currents in Relays checks

Distance Protection Directional Polarity checks

IDMT Directional Polarity checks

Group **14. Protection and Control Schemes**

\_Protection and Control Schemes

110 Volt circuit breaker control circuits (12/7)

110 Volt DC Power Supplies (9/3)

48 Volt DC Power supplies (9/2)

50V DC Direct Wire Control Boards Standard Circuit Diagrams (12/55)

Alarm and Tripping Arrangements Wound VTs (5/6)

Automatic Switching of Transmission Circuits (5/13)

Busbar Protection AC and DC Circuit Diagrams (12/75-80)

Busbar Protection for Double Bus Stations (5/4)

Circuit Breaker Fail Protection (5/16)

Control Schemes for Power Operated Isolators (3/85)

DAR Tunnel Cable Fault Lockout (5/17)

Direct Wire Switchgear Remote Control (P/Stns) Instrumentation (6/8)

Direct Wire Switchgear Remote Control Instrumentation (6/7)

Distance Protection Acceleration (5/8)

Interlocked Distance Protection (5/10)

Interlocking principles for transmission substations (3/9)

Low Frequency Disconnection Relay Facilities (5/28)

Power Operated Isolators (3/15)

Protection Arrangements for Plant and Feeders (5/11)

Protection Signalling Equipment (7/5)

Protective Relay Standard DC Circuit Diagrams (12/26) (Local)

Protective Relay Standard DC Circuit Diagrams (12/27) (Remote)

Standard CT and VT Ratings and Scales (8/2)

Standard intertripping Circuit Diagrams (12/4)

Synchronising Equipment Instrumentation (6/12)

Telemetered Voltage indications (6/3)

Tripping of Remote Circuit Breakers (5/20)

**ETA QL 6 - Transmission Safety**

Group **Transmission Safety**

\_Transmission Safety

Group **1. General safety codes of practice**

\_General safety codes of practice

GS-A1 - Reporting accidents, incidents and specified events

GS-AO - Index

GS-C11 - Safe use of pesticides

GS-C3 - Polychlorinated Biphenyl apparatus

GS-C4 - Carbon dioxide precautions

GS-C6 - Flammable gases

GS-C7 - General safety - SF6 gas

GS-E1 - Access disconnectors/fault interfering mode

GS-E2 - Conductor trolleys/bundled conductor transmission lines

GS-E3 - Skycradles over roads and railways

GS-E4 - Electronic and electrical instrumentation

GS-E5 - Conductor stringing on transmission lines

GS-EH11 - Health precautions re water systems

GS-EH14 - Visual display units

GS-EH16 - Implementation of COSHH

GS-EH17 - Breathing apparatus

GS-EH6 - Protection of hearing

GS-EH8 - Insulation with man made mineral fibres

GS-EH9 - Asbestos materials

GS-F1 - Fire

GS-M1 - Repair of leaks by injection

GS-M4 - Control, inspection and management of scaffolding

GS-M5 - Pressure systems and transportable gas

GS-MP1 - Reporting of site emergencies

GS-MP10 - Manual handling of loads

GS-MP2 - Management of safety aspects of contracts

GS-MP5 part 1 - Approval proc, tools equipment and processes

GS-MP5 part 2 - Approval proc, tools equipment and processes

GS-MP7 - Addition/removal plant and apparatus

GS-MP8 - Work on earth wires

GS-MP9 - Risk assessment

GS-OH1 - Hearing assessment and audiometry

GS-OP10 - Ionising radiations

GS-OP2 - Safe use of helicopters

GS-OP3 - Work on or near water

GS-OP7 - Tree work

GS-OP9 - Working at height in substation