



Department for
**Innovation,
Universities &
Skills**

Guide to the MSc Professional Engineering

**A work-based postgraduate pathway to
Chartered Engineer registration**

*Flexible Pathways to becoming a Professional Engineer
A DIUS Gateways Development Funded Project*

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EXECUTIVE SUMMARY

The Engineering Council UK (EC^{UK}) regulates the engineering profession in the UK. It works through 36 professional engineering institutions and societies, which it has licensed to assess those of their members who wish to become registered with EC^{UK} as Chartered Engineers, Incorporated Engineers or Engineering Technicians.

EC^{UK} has developed standards for registration which reflect employer needs. It works closely with employer organisations and the education sector to ensure that the competences needed to practise engineering are understood and that qualifications to underpin these are identified, and where possible accredited.

The MSc in Professional Engineering has been devised as part of the EC^{UK} DIUS-funded Gateways Project, *Flexible Pathways to becoming a Professional Engineer*, to provide a pathway to registration as a Chartered Engineer through work-based learning. A work-based pathway to Incorporated Engineer has also been developed.

Work-based learning provides a means of concurrently acquiring and utilising underpinning knowledge, understanding and skill-sets in work in order to meet Masters level requirements and demonstrate competence. Competence acquisition can occur before, during or after a degree programme¹. This guide describes how suitably focused work-based learning can be monitored and regulated in order to meet the United Kingdom Standard for Professional Engineering Competence (UK-SPEC) threshold competences for CEng registration.

This CEng programme, which matches participants' learning to QAA Masters level criteria, builds on Kingston University's existing work-based learning approach. It provides an affordable mechanism that provides an opportunity for candidates to achieve the UK-SPEC threshold competences without the need to take significant time away from work.

The objective of this initiative is to offer a regulated nationwide work-based mechanism that Professional Engineering Institutions (PEIs) can assess to assure themselves that Masters level knowledge and understanding alongside professional development are suitable for their members to become potential registrants. EC^{UK} encourages Higher Education Institutions to consider validating, and PEIs to consider accrediting, this regulated work-based MSc Professional Engineering programme.

The availability of such an affordable work-based route to CEng registration should mean that many more individuals, including those engineers² working in smaller organisations, will be in a position to develop their knowledge and build on their existing competences, thereby improving their professional standing and increasing the nation's stock of top level engineers. Employers will also benefit through the development of their workforce in areas directly relevant to their business.

¹ UK-SPEC states that developing competence acquisition may occur at the same time as formal education through industrial placements and other industry-based activities (UK-SPEC Professional Development)

² Well over 90% of UK employees work for SMEs

1. INTRODUCTION

1.1 THE PROJECT AIMS

These are to:

- develop and pilot a model pathway to professional registration of engineers in which higher education and professional development are combined through a work-based approach;
- target groups who are under-represented in the engineering profession at present;
- help address the shortage of engineers and have a positive impact on retention.

These are being delivered by producing a set of work-based programmes, all conforming to a common framework that will be implemented by participating HEIs and in due course considered for accreditation by PEIs. Each programme allows participants to gain sufficient knowledge, understanding and concurrent skill-sets within the work-place to demonstrate UK-SPEC threshold competences through highly-regulated and structured work-based learning and professional development. Eventual accreditation by PEIs will remove the need for each individual candidate's programme to be assessed.

1.2 DOCUMENTATION STRUCTURE

This guide prescribes and describes the framework for the structure and organisation of the work-based MSc Professional Engineering programme. Each Higher Education Institution (HEI) delivering the programme will be required to ensure conformity to this framework, described in Section 3 of this document. In addition, each HEI will develop its own operating manual that describes its own processes in more detail.

1.3 BACKGROUND

EC^{UK} was awarded funding from the DIUS *Gateways to the Professions* Development Fund in 2006 to develop a suite of programmes that established models of flexible pathways into and through Higher Education, leading to professional status in engineering. The project developed the existing successful work-based learning models run by Kingston University to provide pathways to professional recognition. These pathways integrate education, from Foundation to Masters degree level, with supervised work-based professional development, thus potentially satisfying the requirements for professional registration. The expectation is that such work-based programmes will create new markets amongst engineers who wish to achieve registration, but are unwilling or unable to attend university-based higher education for various reasons, such as the prospect of time away from work and additional debt.

The need to design '*clear, accessible gateways for people who want to pursue professional careers*' is one of a number of recommendations in the *Gateways to the Professions Report* by Sir Alan Langlands, published in November 2005. Other recommendations, such as enabling flexible recruitment and training strategies, embracing students without exemplifying qualifications for their chosen career, and developing programmes that are increasingly relevant in both an international and a European context are expected to be addressed as the engineering programmes become established.

EC^{UK} is the principal partner in this project. Kingston University is the lead academic partner with three other HEIs completing the first tier of HEI partners: the University of Hertfordshire, Northumbria University and Staffordshire University. Other universities and colleges are now involved as the model is rolled out. A key feature of the project is the opportunity to benefit from the universities' existing links with industry. The aspiration is to involve a range of educational institutions to reflect type, size, engineering provision and

geographic location. The Professional Engineering Institutions (PEIs) have an important role to play, in particular by ensuring that the programmes will enable participants to seek professional registration whilst also widening participation. The Institution of Engineering & Technology (IET), the Institution of Mechanical Engineers (IMechE) and the Royal Aeronautical Society (RAeS) have participated in the project since its inception, and others are now involved. Participating PEIs and academic institutions ratify a protocol with EC^{UK}. A Steering Committee includes representatives from HEIs, PEIs, employers and Sector Skills Councils.

1.4 BECOMING REGISTERED AS A CHARTERED ENGINEER

In order to be registered as a Chartered Engineer (CEng), a candidate needs to demonstrate within a Professional Review undertaken by a PEI that the UK-SPEC threshold standards of competence and commitment have been met. Those who, based on the evidence provided in their applications, meet these UK-SPEC requirements are asked to attend a Professional Review and Interview (PRI) with registered engineering professionals. Successful candidates are registered as CEng.

The development of competence and commitment requires the acquisition of skill sets and experience for which underpinning knowledge and understanding has to be acquired. Education and Professional Development are the two key activities which facilitate this:

Education

Formal qualifications awarded after pursuing an educational programme provide the usual method of demonstrating underpinning knowledge and understanding for professional competence. The qualifications which exemplify the required knowledge and understanding for Chartered Engineers are:

- an accredited Bachelors degree with honours in engineering or technology, plus either an appropriate accredited Masters degree or appropriate further learning to Masters level

or

- an accredited integrated MEng degree.

Candidates who do not have such exemplifying qualifications must clearly demonstrate that they have achieved the same level of knowledge and understanding as those who do. They can do this by one of the following means:

- writing a technical report, based upon experience, and demonstrating knowledge and understanding of engineering principles;
- taking EC^{UK} examinations;
- following an assessed work-based learning programme;
- taking an academic programme specified by the institution to which they are applying.

Candidates without the exemplifying qualifications are treated as *individual cases* by the PEIs when their applications for EC^{UK} registration are considered.

Professional Development

This is a key part of developing competence. It enables potential Chartered Engineers to learn to apply their knowledge and understanding, and to begin to apply professional judgement.

Although this system of gaining academic qualifications followed by professional development in the work-place works satisfactorily for many, a much greater number of eligible candidates could proceed to CEng status if an affordable and supportive route existed for engineers currently working in industry. This requires a regulated mechanism that allows working individuals who are completing masters level learning as part of their work activities, to follow an approved work-based programme that, regardless of the company size:

- provides a means of obtaining the degree without the need for significant time away from work;
- provides an opportunity for participants to meet the UK-SPEC competence threshold;
- allows all suitable employees to participate and become candidates for registration;
- proactively guides each candidate, step-by-step, towards a CEng Professional Review and Interview.

2. WORK-BASED LEARNING & UK-SPEC

2.1 Work-based learning can provide a means of concurrently acquiring and utilising both underpinning knowledge, understanding and skill-sets in order to demonstrate competence. A report to HEFCE³ indicates that *learning in the workplace is learning through work that is embedded and accredited with a higher education programme.*

2.2 It is a common misperception that work-based learning contributes first to the candidates' education and then to their professional development. However, under UK-SPEC, where competence is a criterion for registration, their order is not prescribed; education and professional development may occur concurrently.

2.3 Where a programme of work-based learning is validated by a university as meeting its academic requirements for the award of a suitable MSc, then that programme may be considered by a PEI as providing sufficient underpinning knowledge and understanding for it to be accredited for CEng. Concurrent professional development within the workplace that provides appropriate skill-sets enables an individual to develop the necessary competences to be considered by a PEI for CEng registration at a Professional Review.

2.4 Participants will usually hold an accredited BEng degree and through this programme, they may achieve the necessary further learning to Masters level and undergo sufficient work-based professional development to be considered for CEng registration.

Potential participants without such a qualification may participate subject to an assessment of their existing academic qualification(s).

2.5 In using the UK-SPEC competence and commitment statements, participants may seek advice and guidance from their PEI, which may be able to put them in touch with a mentor

³ Towards a Strategy for Workplace Learning - http://www.hefce.ac.uk/pubs/rereports/2006/rd09_06/rd09_06.doc

to assist them through the process and help them identify where their competences require development.

- 2.6 In some cases employers may use occupational standards or competence frameworks in determining job descriptions and staff development and these may assist in developing a competence profile; these methods alone, however, do not normally lead to an academic award.

3. THE MSc PROFESSIONAL ENGINEERING

3.1 THE FRAMEWORK

The principles associated with the MSc Professional Engineering are:

- **Work-based learning.** The programme provides the participant with the opportunity to acquire during the period of study the underpinning knowledge and understanding and to develop the UK-SPEC standards of competence, without the need to attend a taught programme.
- **QAA and UK-SPEC conformance.** The programme conforms with QAA's level descriptor learning requirements and engineering subject bench mark statement⁴ and the UK-SPEC requirements for a Masters degree for CEng⁵.
- **Entry gateway.** Each participant undertakes a Professional Development Audit (PDA) entry gateway⁶. This PDA is a reflective examination and assessment of the participant's education, qualifications, experience and competences upon enrolment. This is then used to:
 - 1) determine the difference between current competences and those of UK-SPEC;
 - 2) define the scope of their MSc Learning Contract;
 - 3) provide a record of how the candidate intends to meet the required competences.
- **Exit gateway.** The programme finishes with an exit gateway. This is an overall evaluation of the participant's achievement of their learning goals. It typically takes the form of a viva voce, or equivalent, and includes a UK-SPEC threshold competences analysis.
- **Validation.** Each programme will be validated by its delivering HEI and will be subject to all of that HEI's quality assurance processes.

3.2 ENTRY TO THE MSc PROFESSIONAL ENGINEERING PROGRAMME

The programme is for those already in employment in the engineering profession. As part of the proposed Gateways work-based escalator, illustrated in the *MSc Professional Engineering Process Map* shown on page 9, candidates may apply to enter the programme from any point in their career. They should be in a role that provides them with the opportunities to develop the necessary competences.

Each participant's competences are recorded and assessed at the start of the Learning Contract formulation through the completion of the Professional Development Audit (PDA),

⁴ <http://www.qaa.ac.uk/academicinfrastructure/benchmark/statements/engineering06.pdf>

⁵ http://www.engc.org.uk/documents/EC0005_AHEPBrochure_MR.pdf

⁶ A PDA or similarly entitled entry gateway fulfilling the same purpose

or an equivalent Entry Gateway activity. A competence mapping exercise is then used to determine the goals needed to address the difference between PDA and UK-SPEC threshold competences. The participant is then able to work to achieve a series of learning and competence-building goals knowing that the completion of the Learning Contract is likely to meet the UK-SPEC thresholds⁷.

Early contact between the student and professional engineering institution, overseen by the university or college, is essential and the process is outlined on the engineering gateways website: www.engineeringgateways.co.uk The PEI provides feedback as to whether the documentation is an acceptable base for eventual professional review.

3.3 THE LEARNING CONTRACT

The Learning Contract is a work plan of how an individual can gain knowledge and competence whilst meeting company objectives. It is written in the form of a sequenced professional development plan linked to the company's activities. Section 5 of this guide provides further detail.

The Learning Contract is designed to raise the participant's levels of underpinning knowledge, understanding and skill-sets, mapped against UK-SPEC CEng competences, to enable them to become a candidate for CEng registration. It also ensures that participants, assessors and reviewers understand:

- what additional learning needs to take place and the credits which will be awarded;
- how it is to be achieved and assessed;
- how the activities meet the competence statements; and
- the estimated date of achievement when the participant can reasonably expect to be successful, subject to completion of the intended learning outcomes.

Alongside the Learning Contract, a record of professional development is maintained. Where PEIs have published frameworks for recording the development of professional competences, these can be completed alongside the programme documentation. The participant's PEI will provide guidance on how to record professional development. The PEI will also provide details of any specific additional requirements, how to achieve registration and any step-by-step help available.

Employer support will normally include a named company mentor. A guidance note on mentoring and assessment, published on the engineering gateways website, provides further details about roles and responsibilities.

3.4 MEMBERSHIP OF A PROFESSIONAL ENGINEERING INSTITUTION

The educational provider will ensure that each programme participant completes a membership application form for the PEI of his or her choice at the appropriate grade. Some participants will be members already. A process map on the engineering gateways website outlines document requirements and responsibilities: www.engineeringgateways.co.uk.

3.5 CANDIDATES FOR REGISTRATION – THE EXIT GATEWAY

The Exit Gateway provides the final assessment of learning outcomes. This includes the examination of a work-based learning portfolio and, possibly, written examinations and a *viva voce* examination. Based on the record of professional development it also assesses the competence developed against the UK-SPEC competences. Successful completion of

⁷ HEI Operating Manual – competence threshold analysis method

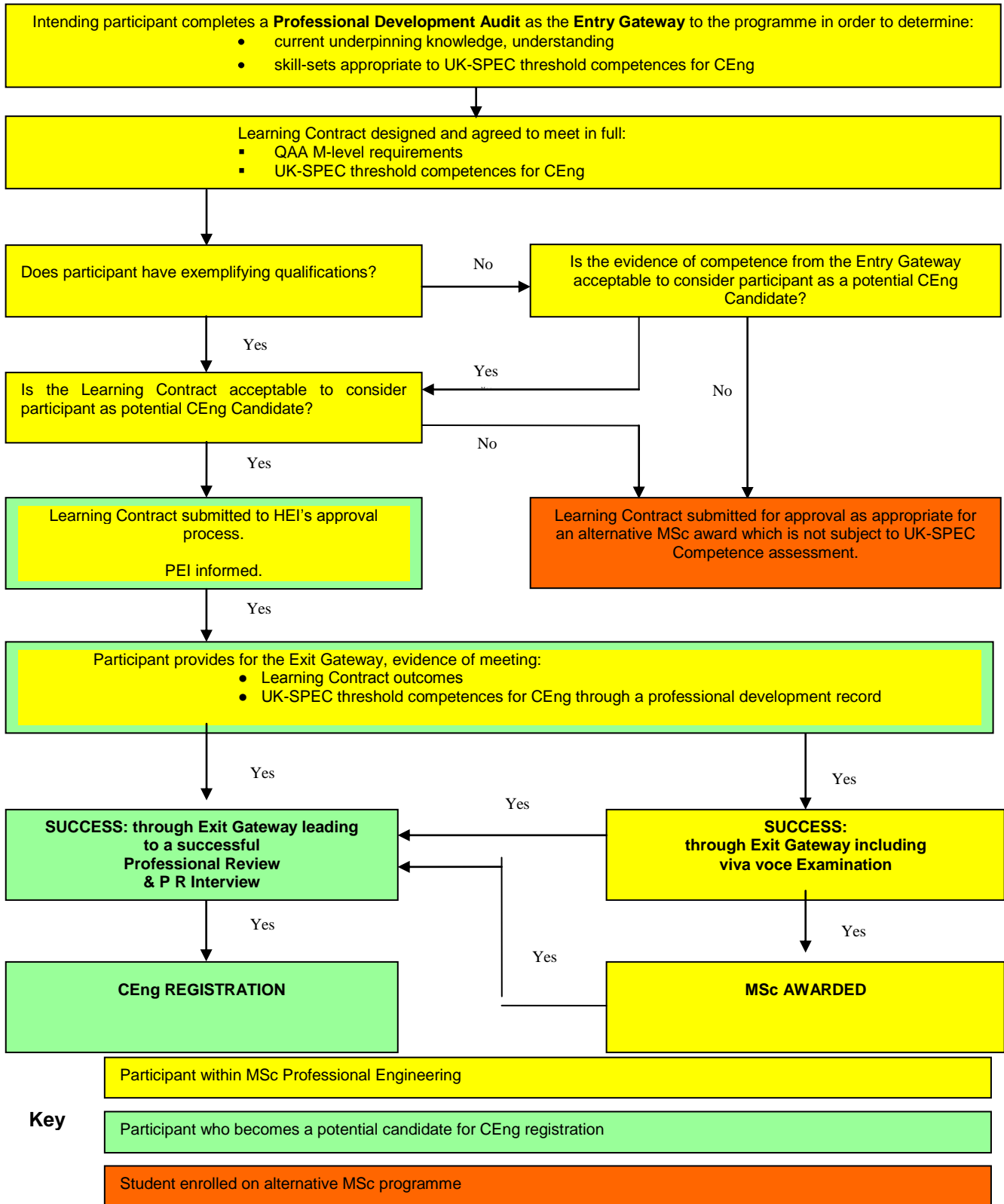
the programme results in an academic award and, assuming the competence requirements are met, eligibility to apply for registration through the normal PEI process of professional review and interview.

The completed work-based Learning Contract and the professional development record provide evidence for the PEI's professional review.

It is important to emphasise that, as for all candidates for professional review, there is no guarantee of professional registration, even for those awarded a Masters degree in Professional Engineering. What the programme does offer is a process of committed, step-by-step help throughout, a work-friendly means of achieving additional learning and a way of having competences assessed *en route* to the participants' professional review and interview.

The pathway is dependent on the HEI process running alongside the PEI process, as shown in the *MSc Professional Engineering process map* (page 9).

3.6 THE MSc PROFESSIONAL ENGINEERING PROCESS – MAP



4. THE PROFESSIONAL ENGINEERING INSTITUTIONS

4.1 ACCREDITATION OF THE MSc PROFESSIONAL ENGINEERING

In conventional taught programmes, the intended academic content in the form of general learning outcomes is assessed against UK-SPEC and may subsequently be accredited by a PEI. The HEI then delivers set learning experiences based on the learning outcomes. The MSc Professional Engineering programme is similar. The HEI then uses a Learning Contract and mapping mechanism to ensure that the individually designed Learning Contract goal or specified module maps against the accredited learning outcomes and hence UK-SPEC.

The learning outcomes shown in the individual HEI's operating manual are validated by the HEI and may be accredited by a PEI. Thus the role of the HEI and the PEI is the same for both taught and work-based methods in that they are required to ensure the intended learning outcomes are at a level that meets the QAA and UK-SPEC requirements and they have confidence that the HEI outcomes will be delivered.

In the case of the MSc Professional Engineering programme, there is a staged process:

- PEIs review the participant's documentation at an early stage and confirm whether this is an acceptable base for eventual professional review
- At an appropriate point the PEIs review the individual HEI's Operating Manuals and any further documents for compliance with the principles of this Guide and UK-SPEC and accredit the HEI's programme accordingly.

4.2 ASSESSMENT OF COMPETENCE FOR CEng REGISTRATION – THE PROTOCOL

The PDA and resulting Learning Contract ensure that the participant, the academic supervisor and the employer are clear at the outset about the activities and outcomes that meet both MSc and UK-SPEC competence requirements for successful completion of the programme.

A Protocol between EC^{UK} and the PEIs sets out the process for recognising participants following programmes adhering to this EC^{UK} model.

Once a sufficient number of participants have successfully completed the MSc, the PEIs may be in a position to confer accreditation. This would then enable each participant to be dealt with as a candidate for CEng Registration via the Standard Route, with the Learning Contract not requiring individual verification by the PEI.

5. THE LEARNING CONTRACT APPROACH TO WORK-BASED LEARNING

The purpose of a Learning Contract is to set out what learning goals are to be achieved and/or modules are to be successfully completed as a result of work-based activities, and how development of competence is to be evidenced. It is developed together by the employee, an academic supervisor and professional mentor/advisor. Involvement of the employer is key as they need to confirm that they will be able to provide the participant with appropriate and sufficient experience.

The approach enables working engineers to obtain an appropriate qualification without the need to complete a taught course. The Learning Contract provides a framework that enables the learning experience to be tailored specifically around work and the requirements of a PEI. Within the Learning Contract, a designated academic supervisor helps an existing company employee to complete a company-critical work programme that is set out in the form of learning objectives and milestones. This may consist entirely of individual learning goals, based on current and future work activities, or it may include some taught modules. It may also be possible to gain credit from courses attended in the past, as well as previous work-based activities, provided they meet QAA M level descriptors. Nationally recognised credits at the appropriate QAA level and benchmark⁸ are awarded for the learning outcomes resulting from these activities.

5.1 KEY FEATURES & BENEFITS

Key features/benefits of the work-based Learning Contract are:

- flexible, individually designed programmes, unique to each participant's needs and situation;
- recognition and accreditation of appropriate previous learning;
- option to attend taught modules, if appropriate;
- access to university learning resources;
- supervisor support throughout the programme.

For the individual, the Learning Contract offers a mechanism whereby an individual may complete a higher degree programme and potentially meet PEI requirements.

An additional potential benefit is knowledge exchange. Companies need to innovate, but often cannot afford the necessary specialist skills or resources. This programme offers the potential for knowledge exchange between universities and industry, and a company can develop staff in key areas without them spending periods away from work.

The learning outcomes, the activities that enable them to be achieved, the method of demonstrating that additional learning has taken place and the method of assessment are defined at the outset in the Learning Contract, thus giving the candidate a clear indication of what has to be achieved. Assessment is on-going and formative, thereby giving the candidate vital feedback on progress.

⁸ QAA Subject Benchmark Statements: www.qaa.ac.uk/academicinfrastructure/benchmark/default.asp.

5.2 HOW DOES THE LEARNING CONTRACT WORK?

- A university academic supervisor normally works with the employer and participant to review competences and achievements to date and identify and define suitably challenging opportunities, through which the individual will gain sufficient M level learning to achieve a Masters degree.
- Together they agree the Learning Contract and ensure that it meets the individual's needs, the QAA level requirements and any necessary regulatory requirements.
- Under agreed supervision, the candidate completes the work-based tasks.
- The goal evidence or module is assessed, all evidence of learning is assembled, a reflective summary is written and presented and, based on this evidence, decisions are made as to the academic quality of the work.
- The participant undergoes examinations that review achievement and, upon satisfactory completion (and subject to Examination Board approval), obtains an appropriate award.

Details of each university-specific Learning Contract are included in the HEI's operating manuals.

5.3 CLARITY OF REQUIREMENT

Within a work-based Learning Contract, the learning outcomes record is crucial. It defines the outcomes to be met, the activities required to meet them and what assessment criteria and mode of assessment will be used.

To ensure confidence, the Learning Contract is reviewed by a subject expert. An independent briefer may also be involved and there may be a rigorous approval process operated by the HEI's Board of Study. The candidate then knows at the outset what is required during the programme.

5.4 LEARNING ACTIVITIES

As well as the learning generated in the workplace, each WBL Masters by Learning Contract programme may include a range of activities that result in additional learning. These could include validated university examined Masters level modules, company courses, validated professional courses, APL, APEL, company projects, learned papers and a reflective summary.

5.5 ASSESSMENT

The aim, where possible, is to use evidence of learning generated in the workplace to confirm that sufficient additional learning to Masters level has taken place and been applied. University module examinations show the acquisition of knowledge but authenticated work outcomes show application. Potentially this may lead to fulfilment of PEI requirements in regard to both underpinning knowledge and understanding and competences.

Achievement is assessed by the supervisor (and usually the second assessor) at the time of submission. An external examiner is in place for each award. The MSc programme concludes with an Exit Gateway assessment (see section 3.5). Participants are required to demonstrate an innovative and autonomous response to a demanding situation, or a difference in current methodologies. This can be demonstrated through analytical means or

the synthesis of information, the latter often demonstrating the ability to exhibit the complexity and depth of reason that befits a Chartered Engineer.

It is intended that participants will be eligible to apply for a Professional Review once they have completed their work-based programme according to their individual Learning Contract.

6. QUALITY ASSURANCE

As with accredited taught programmes, the MSc Professional Engineering programmes will be subject to the university's normal internal validation and quality assurance processes in line with QAA requirements.

7. CONCLUSIONS

Indicators show that a greater number of eligible candidates could proceed to CEng status if an affordable, work-based and supportive route existed for all practising engineers. In the case of CEng, the MSc Professional Engineering process meets a need for a regulated mechanism that allows working individuals to follow a work-based, postgraduate programme and demonstrate the necessary competences and underpinning knowledge, regardless of the size of the employer.

None of the elements of the MSc Professional Engineering process is new. What is new is the way they have been combined to provide an additional pathway for those who wish to become professional engineers.

The model offers an imaginative and potentially very successful way forward to increase the number of registered engineers. The processes outlined in this guide and the supporting documents will be developed and reviewed in the light of feedback from stakeholders. Users of the guide are encouraged to contact EC^{UK} with comments or suggested changes for increasing the effectiveness of the framework.