Arrangements for:

SCQF level 5 Group Awards

G988 45: National Certificate in Electrical Engineering
G98D 45: National Certificate in Electronic Engineering
G981 45: National Certificate in Fabrication and Welding Engineering
G983 45: National Certificate in Mechanical Maintenance Engineering
G982 45: National Certificate in Manufacturing Engineering

SCQF level 6 Group Awards

G97H 46: National Certificate in Aeronautical Engineering
G9AF 46: National Certificate in Electrical Engineering
G9AG 46: National Certificate in Electronic Engineering
G984 46: National Certificate in Fabrication and Welding Engineering
G97L 46: National Certificate in Manufacturing Engineering
G987 46: National Certificate in Measurement and Control Engineering
G97J 46: National Certificate in Mechanical Engineering

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Acknowledgement

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of National Qualification Group Awards.

History of changes

It is anticipated that changes will take place during the life of these qualifications, and this section will record these changes. This document is the latest version and incorporates the changes summarised below.

Version number	Description	Date
14	Energy units added to the National Certificate in Electrical Engineering at SCQF level 5 optional section. J12W 75 Energy: An Introduction, J132 75 Energy: Conventional Technologies and the Grid, J12X 75 Energy: Employability and Careers	23/05/24
13	F5FA 12 Shipbuilding Technology added to the Optional Section of the National Certificate in Electrical Engineering at SCQF level 6.	12/09/23
12	F5DG 11 Health & Safety added to the optional section of the NC Manufacturing Engineering SCQF level 6	11/09/23
11	F5FM 12 Engineering Quality: An Introduction added to the optional section of the NC Engineering Electrical SCQF level 6	06/04/23
10	F5H6 12 Robotic and Automated Systems added to optional section of the NC Measurement and Control Engineering framework	18/02/20
09	F5F9 12 Pipework Systems and F5FA 12 Shipbuilding Technology have been added to the optional section of the NC Mechanical Engineering SCQF level 6 framework only	27/11/19
08	F5H4 11 - Computer Aided Draughting (CAD) for Engineers and F5DG 11 - Health and Safety: Engineering added as Optional units to G98D 45 Electronic Engineering Framework.	19/07/18
07	F5D5 12 Engineering Project added as an optional Unit to the level 6 Aeronautical Engineering Framework.	28/04/2016
06	Mathematics: Technician 1 (F3HX 12) added as an optional Unit to the level 5 Manufacturing Engineering Framework.	02/02/2015
05	Mathematics: Technician 1 (F3HX 12) added as an optional Unit to the level 5 Electronic Engineering Framework.	15/01/2015
04	H23W 75 Literacy *has been added as an alternative to* F3GB 11 Communication Fabrication and Welding G981 45, Electronic Engineering G98D 45, Electrical Engineering G988 45, Mechanical Maintenance Engineering G983 45 and Manufacturing Engineering G982 45.	15/05/2014
03	Mathematics: Technician 1 (F3HX 12) added as an optional Unit to the level 5 Electrical Engineering Framework. Combinational Logic (F5HA 11) and Semiconductor Applications (F5JP 12) added as optional Units to the level 6 Electrical Engineering Framework.	18/10/2012
02	Unit F5K1 11 Mechanical Engineering Principles added to the optional section of the award Manufacturing Engineering level 5 (G982 45) and level 6 (G97L 46).	23/01/2012

Contents

Note about National Qualifications Group Awards

National Qualification Group Awards (NQGAs) comprise of National Certificates (NC) and National Progression Awards (NPAs). Both types of award are vocational qualifications designed to prepare people for employment, for career development and for progression to further study.

National Certificates and NPAs are available at SCQF levels 2–6 and can be delivered in colleges or through partnerships between colleges, schools and employers.

National Certificates are primarily aimed at 16–18 year olds and adults in full-time education, normally at a college. They prepare candidates for employment or further study, by developing a range of knowledge and skills. National Certificates have specific aims which relate to occupational areas and are linked to National Occupational Standards.

NPAs are designed to assess a defined set of skills and knowledge in specialist vocational areas. They are mainly used by colleges for short programmes of study. NPAs are linked to National Occupational Standards.

This document presents information on twelve new National Certificate in Engineering awards developed as part of a major SQA/college development between 2005 and 2008. No NPAs were developed as part of this major development. For ease of reading in this Arrangements Document reference is made to National Certificates in Engineering rather than National Qualification Group Awards in Engineering.

1 Introduction

This is the Arrangements Document for the following new National Certificates:

National Certificate in Electrical Engineering at SCQF level 5
National Certificate in Electronic Engineering at SCQF level 5
National Certificate in Fabrication and Welding Engineering at SCQF level 5
National Certificate in Mechanical Maintenance Engineering at SCQF level 5
National Certificate in Manufacturing Engineering at SQCF level 5

National Certificate in Aeronautical Engineering at SCQF level 6
National Certificate in Electrical Engineering at SCQF level 6
National Certificate in Electronic Engineering at SCQF level 6
National Certificate in Fabrication and Welding Engineering at SCQF level 6
National Certificate in Manufacturing Engineering at SCQF level 6
National Certificate in Measurement and Control Engineering at SCQF level 6
National Certificate in Mechanical Engineering at SCQF level 6

These 12 Group Awards were validated in June 2008.

This document includes: background information on the development of the Group Awards, their aims, guidance on access, details of the Group Award structures, and guidance on delivery and assessment.

The above new awards have been designed to replace the following National Certificate Group Awards which finish on 31 July 2011.

G58E 04	National Certificate in Electrical Engineering Practice
G58F 04	National Certificate in Electronic Engineering Practice
G588 04	National Certificate in Fabrication and Welding Engineering Practice
G587 04	National Certificate in Engineering Practice
G58R 04	National Certificate in Aeronautical Engineering Practice
G58N 04	National Certificate in Shipbuilding Engineering Practice

G58P 04	National Certificate in Aeronautical Engineering
G58C 04	National Certificate in Electrical Engineering
G58D 04	National Certificate in Electronic Engineering
G586 04	National Certificate in Fabrication and Welding Engineering
G585 04	National Certificate in Engineering
G58M 04	National Certificate in Shipbuilding

Table 1.1 shows the broad comparisons between the old and new awards.

Table 1.1 Broad comparisons between current and new NC Engineering awards

Old NC Engineering award no.	Old NC Engineering award title	New NC Engineering award no.	New NC Engineering award title
G58E 04	National Certificate in Electrical Engineering Practice	G988 45	National Certificate in Electrical Engineering at SCQF level 5
G58F 04	National Certificate in Electronic Engineering Practice	G98D 45	National Certificate in Electronic Engineering at SCQF level 5
G588 04	National Certificate in Fabrication and Welding Engineering Practice	G981 45	National Certificate in Fabrication and Welding Engineering at SCQF level 5
G587 04	National Certificate in Engineering Practice	G983 45 G982 45	National Certificate in Mechanical Maintenance Engineering at SCQF level 5 and National Certificate in Manufacturing Engineering at SQCF level 5
G58R 04	National Certificate in Aeronautical Engineering Practice		No comparable award.
G58N 04	National Certificate in Shipbuilding Engineering Practice		No comparable award. A Unit in Ship Construction Skills is included in the Optional Section of the National Certificate in Fabrication and Welding Engineering at SCQF level 5
G58P 04	National Certificate in Aeronautical Engineering	G97H 46	National Certificate in Aeronautical Engineering at SCQF level 6
G58C 04	National Certificate in Electrical Engineering	G9AF 46	National Certificate in Electrical Engineering at SCQF level 6
G58D 04	National Certificate in Electronic Engineering	G9AG 46	National Certificate in Electronic Engineering at SCQF level 6

Table 1.1 (continued)

Old NC Engineering award no.	Old NC Engineering award title	New NC Engineering award no.	New NC Engineering award title
G586 04	National Certificate in Fabrication and Welding Engineering	G984 46	National Certificate in Fabrication and Welding Engineering at SCQF level 6
G585 04	National Certificate in Engineering	G97L 46 G97J 46	National Certificate in Manufacturing Engineering at SCQF level 6 and National Certificate in Mechanical Engineering at SCQF level 6
G58S 04	National Certificate in Measurement and Control	G987 46	National Certificate in Measurement and Control Engineering at SCQF level 6
G58M 04	National Certificate in Shipbuilding		No comparable award. A Unit in Ship Technology is included in the Optional Section of the National Certificate in Fabrication and Welding Engineering at SCQF level 6.

2 Rationale for the development of the Group Award(s)

2.1 Introduction

The National Certificate awards in Engineering Practice and Engineering have been in existence since the early 1990's. During the time they have been available thousands of candidates have successfully used these Group Awards as part of their education and training to become skilled engineering craftspersons or technicians. However, given the age of the awards it was considered appropriate in 2005 to review and revise these Group Awards to ensure that the proposed new awards reflected more closely current technologies, industrial practices and advancements in education. It was also necessary to ensure that the new Group Awards conformed to the new SQA National Qualification Group Award (NQGA) design principles.

Another critical aspect of the National Certificate in Engineering awards development was to rationalise and update the large number of NC (National Certificate) Engineering modules in the SQA catalogue. Many of these NC modules had become dated and in urgent need of revision. The review and updating of NC modules (now called NQ units) has been completed as part of the National Certificate in Engineering development project.

2.2 Management of the National Certificate in Engineering development process

It is important at the outset of this Section to explain briefly the arrangements that were put in place to manage the National Certificates in Engineering development process. The overall development was led by a Qualifications Design Team (QDT) consisting of four Team Leaders, the Qualification Manager for Engineering and the Qualifications Officers for Engineering. The four Team Leaders have also led developments in the following four broad engineering curriculum areas:

- Electrical and Electronic Engineering
- Fabrication and Welding (including Ship Building)
- Aeronautical Engineering, Manufacturing Engineering and Mechanical Engineering
- Measurement and Control Engineering

Developments in each of the four curriculum areas were taken forward by a sub-team led by the appropriate QDT Team Leader with an SQA Qualifications Officer in support. Members of each sub-team were drawn from Further Education College staff with many years of teaching and industrial experience. This combined experience was considered essential in that it allowed individual members of the groups to bring to the development a thorough knowledge and understanding of engineering theory, first-hand awareness of current industrial practices and technologies and knowledge of the learning/teaching strategies which might be used during the delivery of the individual NQ units and awards as a whole.

2.3 Market research to support National Certificates in Engineering developments

Market research to support the development of the National Certificates in Engineering was undertaken using the following approaches:

- Desk based research
- Consultations with Further Education and Training Providers
- Consultations with Sector Skills Council Representatives and Employers

Brief details of the ways in which these three types of market research were conducted are shown in Table 2.3.

Table 2.3 Types of Market Research used to support National Certificate in Engineering developments

Type of Research	Nature of Research
Desk Based	♦ Analysis of trends in engineering as revealed in Futureskills Scotland/Sector Skills Council reports ♦ Consultation report prepared by an SQA consultant on an educational view of the engineering landscape up to and beyond 2010
Consultations with Further Education and Training Providers	♦ Initial consultation exercise with FE colleges using an educational consultant ♦ Initial questionnaire survey with FE colleges ♦ Two major seminars on the NC Engineering developments which included workshop sessions at which lecturers could feedback their views on developments ♦ A further questionnaire consultation initiated at the second seminar in 2007 ♦ Consultations with the Scottish Association for Engineering Education (SAFEE). For example, SAFEE allowed SQA representatives an item about National Certificates in Engineering on the agenda of both its 2006 and 2007 national conferences.

Type of Research	Nature of Research
Consultations with Further Education and Training Providers (continued)	♦ SAFEE questionnaire survey on the uptake of new NQ Engineering units ♦ Power Point presentation on the NQGA in Engineering to training provider representatives at a SEMTA conference followed by a Question and Answer session
Consultations with Sector Skills Council Representatives and Employers	♦ Initial limited consultation with employers ♦ Papers informing the SQA Sector Panel for Engineering, Science and Mathematics (which includes Sector Skills Council representatives) of developments in the National Certificates in Engineering award ♦ A major presentation on National Certificate in Engineering developments in October 2007 ♦ A questionnaire survey supported by Scottish Engineering

It is important to emphasise that the analysis, feedback and comments arising from the various market research exercises have been used by the QDT and sub-groups of the QDT to inform National Certificate in Engineering developments.

2.4 The Nature and Purpose of the National Certificate Engineering Awards

National Certificates in Engineering at SCQF level 5

The primary focus of these qualifications is to provide candidates with a range of engineering practical skills relevant to the title of the National Certificate they are studying, supported by some theory where appropriate. As such these awards are suitable for those candidates who wish to become skilled crafts persons/trades persons, maintenance fitters or operatives. Traditionally training and education at engineering craft level has started at SCQF level 5 (eg the previous National Certificate in Engineering Practice Group Awards were at level 5) so the level of the new qualifications is completely appropriate.

National Certificates in Engineering at SCQF level 6

The primary focus of these qualifications is different from the level 5 awards in that they have been designed to provide a balance of practical and theory suitable for candidates who wish to work at technician level. Traditionally, education and training for engineering technicians has commenced at SCQF level 6 (eg the previous National Certificate in Engineering Group Awards were at level 6) so the level of the new awards is entirely appropriate.

3 Aims of the Group Award(s)

In this section details are provided of the aims, rationale, target groups and employment opportunities for the National Certificate in Engineering awards at levels 5 and 6.

3.1 Principal aims of the Group Awards

The principal aims of the new National Certificates are to:

3.1.1 provide awards that will allow candidates to work now, or in the future, at craft or technician levels in an engineering environment;

3.1.2 provide awards that create a route towards meeting the academic requirements for Engineering Technician status;

3.1.3 provide awards that on successful completion will allow candidates to progress to an HNC or HND or degree in an engineering or related subject discipline;

3.1.4 allow candidates to develop knowledge, understanding and skills in *Communication, Numeracy* and *Information and Communication Technology* that underpin and support their studies in engineering;

3.1.5 allow candidates to develop knowledge, understanding and skills in an area of engineering which relates directly to the title of the award the candidate is studying;

3.1.6 allow candidates a degree of specialisation in engineering relevant to the area of engineering covered by the award;

3.1.7 on successful completion of an award allow candidates to achieve Core Skills in *Communication, Numeracy* and *Information and Communication Technology*. Furthermore to provide candidates with opportunities to develop the *Problem Solving* and *Working with Others* Core Skills.

Expansion of Aims 3.1.5 and 3.1.6 for individual National Certificate in Engineering awards

It will be noted that Aims 3.1.5 and 3.1.6 have been written in general terms. In this section these two aims are contextualised to individual National Certificate in Engineering awards.

National Certificate in Electrical Engineering at SCQF level 5

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in electrical principles, electrical systems and electrical testing and measurement and undertake some degree of specialisation in electrical installation or electrical installation and electrical plant subjects at SCQF level 5.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in electrical installation or electrical plant subjects or a combination of the two at SCQF level 5. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Electronic Engineering at SCQF level 5

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in electrical principles, fundamental electronics and electrical test equipment and measurement and undertake some degree of specialisation in practical electronics or electronic theory or a combination of the two at SCQF level 5.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in practical electronics or electronic theory or a combination of the two at SCQF level 5. Candidates may also take Units in Mathematics, Electrical Systems or Electrical Test and Measurement (as part of their 4 optional units) if they wish to specialise further in these subjects.

National Certificate in Fabrication and Welding Engineering at SCQF level 5

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in fabrication and welding processes and health and safety and undertake some degree of specialisation in practical welding and fabrication skills and some of the theory underpinning fabrication and welding at SCQF level 5.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in practical welding and fabrication skills (including pipefitting and ship construction skills) or some of the theory underpinning fabrication and welding or a combination of the two at SCQF level 5. Candidates may also take a further Unit in Mathematics (as one of their 4 optional Units) if they wish to specialise further in this subject.

National Certificate in Mechanical Maintenance Engineering at SCQF level 5

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in core practical and theoretical aspects of mechanical plant maintenance including Health and Safety at SCQF level 5.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the practical and theoretical aspects of mechanical plant maintenance at SCQF level 5. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Manufacturing Engineering at SCQF level 5

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in core theoretical and practical aspects of manufacturing engineering at SCQF level 5.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the practical and theoretical aspects of manufacturing engineering at SCQF level 5. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Aeronautical Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge and understanding in aeronautical fundamentals and aircraft systems and undertake some degree of specialisation in the theory underpinning aeronautical engineering or practical aviation skills and the theory underpinning aeronautical engineering at SCQF levels 5 and 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the theory underpinning aeronautical engineering or practical aviation skills and the theory underpinning aeronautical engineering at SCQF levels 5 and 6. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Electrical Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in electrical principles, electrical systems and electrical testing and measurement and undertake some degree of specialisation in electrical installation or electrical installation and electrical plant subjects at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in electrical installation or electrical plant subjects or a combination of the two at SCQF level 5. Candidates may also take a further Unit in Mathematics or Electrical Principles (as part of their 4 optional units) if they wish to specialise further in these subjects.

National Certificate in Electronic Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in electrical principles, fundamental electronics and electrical test equipment and measurement and undertake some degree of specialisation in the theory underpinning Electronics at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the theory underpinning Electronics at SCQF level 6. Candidates may also take Units in Mathematics, Electrical Systems or Electrical Test and Measurement (as part of their 4 optional units) if they wish to specialise further in these subjects.

National Certificate in Fabrication and Welding Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in fabrication and welding processes and undertake some degree of specialisation in the theory underpinning fabrication and welding at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in some of the theory underpinning fabrication and welding (including pipefitting and ship construction theory) or practical welding skills and the theory underpinning fabrication and welding or a combination of these two at SCQF level 6. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Manufacturing Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in core theoretical and practical aspects of manufacturing engineering at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the practical and theoretical aspects of manufacturing engineering at SCQF level 6. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Measurement and Control Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in core theoretical and practical aspects of measurement and control engineering at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in the theoretical and practical aspects of measurement and control engineering at SCQF level 6. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

National Certificate in Mechanical Engineering at SCQF level 6

Corresponding to Aim 3.1.5

Allow candidates to develop knowledge, understanding and skills in statics, dynamics and thermofluids and undertake some degree of specialisation in the theory underpinning mechanical engineering at SCQF level 6.

Corresponding to Aim 3.1.6

Allow candidates to specialise further in mechanical engineering or mechanical plant maintenance or a combination of the two at SCQF level 6. Candidates may also take a further Unit in Mathematics (as one of their 4 optional units) if they wish to specialise further in this subject.

3.2 General aims of the Group Award(s)

Other aims of the proposed new National Certificates are to:

3.2.1 enhance candidates' employment prospects;

3.2.2 support candidates' career development and Continuing Professional Development;

3.2.3 enable progression within the SCQF (Scottish Credit and Qualifications Framework);

3.2.4 develop learning and transferable skills.

3.3 How the Principal aims are met in the National Certificates in Engineering qualifications

Aim no.	How it is met in NC qualifications
3.1.1	National Certificates in Engineering have for many years been recognised by employers and other stakeholders of these awards as appropriate qualifications for persons wishing to work at engineering craft and technician levels. Market research (see Section 2.3) indicates that there is still a demand for engineering craft/trades persons and technicians. Thus, it is confidently anticipated that a candidate achieving one of the National Certificates in Engineering will find employment as a craftsperson or engineering technician in a wide range of small, medium or large companies. It is important to note that the National Certificates in Engineering at SCQF level 5 have been developed primarily to provide education and training for craftspersons whereas the National Certificates in Engineering at SCQF level 6 have been developed principally for the education and training of technicians.
3.1.2	A National Certificate in Engineering at SCQF level 6 may partially or fully satisfy the academic requirements for engineering technician status depending on the professional body the candidate is applying to. For fuller details see Section 5.7.
3.1.3	Articulation routes between National Certificates in Engineering, Advanced Certificates and HNC and HNDs in Engineering are identified in Table 5.7.1
3.1.4	Market research with FE colleges, employers and other stakeholders of the National Certificate in Engineering qualifications has indicated the importance of retaining distinct Units in Communication, Numeracy/Mathematics and Information Technology in the new awards. The knowledge, understanding and skills contained in these units are seen as essential to the development of crafts persons and technicians irrespective of which engineering discipline they are studying. In terms of the design of the new awards there are common units in Communication, Numeracy and Information Technology at SCQF level 5 within all the National Certificates in Engineering at SCQF level 5, forming, in effect, a mandatory core for these qualifications. Likewise, there are also common units in Communication, Mathematics and Information Technology at SCQF level 6 within all National Certificates in Engineering at SCQF level 6, forming a mandatory core for these qualifications.
3.1.5	From an early stage in the development process, it was decided that it was important to define each of the National Certificates in Engineering in terms of a group of units that closely related to the title of the individual qualification, thus making each award distinctive in its own right. This approach has been broadly accepted by those who have been consulted during the development of the awards. In terms of qualification design, each National Certificate has a Restricted Core section comprising of units that link very closely to the title of the qualification. Candidates can choose any five out of eight Unit credits from this section of the qualification.

3.3 How the Principal aims are met in the National Certificates in Engineering qualifications (cont)

Aim no.	How it is met in NC qualifications
3.1.6	As is the case in the former National Certificates, each new National Certificate in Engineering has an Optional Section in which candidates can choose four Unit credits from a range of engineering units contained in this section. Thus, candidates have scope to specialise to some degree further in the engineering discipline they are studying and/or broaden their knowledge, understanding and skills across engineering. Each optional section also contains a Unit in Mathematics so that candidates can develop their Mathematical knowledge and skills further with a view to progressing to a more advanced course.
3.1.7	The Core Skill Units, Communication at SCQF level 5 and SCQF level 6 sit within the mandatory core section of the National Certificates in Engineering at SCQF level 5 and SCQF level 6 respectively. Therefore, candidates successfully achieving a National Certificate in Engineering will also achieve the Core Skill of Communication at the SCQF level of the award. The delivery and assessment of the Communication Unit should be fully integrated into the delivery and assessment of each National Certificate in Engineering qualification. For example, where candidates have to produce a report as part of an assessment in an engineering Unit, the report could also be used for assessment of the Core Skills. Communication skills of candidates taking National Certificates in Engineering will vary considerably and some candidates will require greater levels of support to improve their Communication skills. Centres should provide each candidate with the level of support appropriate to their needs so that by the time the candidate has completed a National Certificate in Engineering he/she can read, write and speak with technical proficiency appropriate to the level of the award studied. The Unit Mathematics: Craft 1 at SCQF level 5, in the mandatory core of all the National Certificates in Engineering at SCQF level 5, has the Core Skill component Using Number at SCQF level 5 embedded in it. Thus, a candidate successfully completing this Unit will automatically achieve the Core Skill component Using Number at SCQF level 5. The Mathematics: Technician 1 Unit, in the mandatory core of all National Certificates in Engineering at SCQF level 6, has the full Numeracy Core Skill at SCQF level 6 embedded in it. Therefore, a candidate successfully completing this Unit will automatically achieve the Core Skill of Numeracy at SCQF level 6. The Core Skill Information and Communication Technology at SCQF level 5 and SCQF level 6 is embedded within the mandatory core Units Engineering: Using Information Technology at SCQF level 5 and Engineering: Applying Information Technology at SCQF level 6 respectively. The QDT and the QDT sub-teams have identified opportunities to develop the other two Core Skills namely, Problem Solving and Working with Others. Opportunities to develop these Core Skills have been identified in individual NQ Units in the awards. Further details of embedded Core Skills and opportunities to develop Core Skills are provided in Section 5.5 and Appendix 1.

3.4 How the other aims are met in the proposed National Certificates in Engineering qualifications

Aim no.	How it is met in NC qualifications
3.2.1	For many years National Certificates in Engineering have equipped candidates to seek employment in a wide range of industrial, service and public sector organisations. Market research indicates that National Certificates in Engineering are still regarded by many organisations as the minimum qualifications to work at engineering craft and technician levels.
3.2.2	There has been a long tradition of candidates in employment taking National Certificates in Engineering on a part-time basis to increase their knowledge and skills in engineering and, as a result, enhance their career development. It is anticipated in future that many candidates in employment will study the new National Certificates in Engineering on a part-time basis to enhance their knowledge and skills of engineering and as a consequence improve their career development opportunities. In a similar way candidates studying a National Certificate in Engineering on a full-time basis at a centre are being provided with the knowledge and skills to pursue a career in engineering. It is also anticipated that some of the NQ units in the new National Certificates in Engineering may be used for Continuing Professional Development (CPD) purposes. For, example, a candidate may decide to choose a Unit, or units, in Computer Aided Draughting (CAD) for Engineers to develop new knowledge and skills in this subject area. CPD opportunities using new National Qualifications units may also exist in other subject areas such as Programmable Logic Controllers (PLCs), Computer Numerical Control (CNC) and Supervisory Control and Data Acquisition (SCADA), etc
3.2.3	All units within the new National Certificates in Engineering qualifications have been levelled at SCQF levels 5 or 6. The new awards also conform to the SQA Design Principles for NQGA. Thus, progression within the SCQF for successful candidates is assured.

3.4 How the other aims are met in the proposed National Certificates in Engineering qualifications (cont)

Aim no.	How it is met in NC qualifications
3.2.4	The new National Certificates in Engineering provide centres with scope to enhance learning skills not least by creating opportunities for candidates to combine theory and practice to achieve a real understanding of a subject. For example, many NQ units recommend significant use of practical work and/or computer simulation to reinforce learning. It is also anticipated that centres will use innovative delivery approaches that may make use of sophisticated engineering laboratory equipment and/or on-line delivery and/or Virtual Learning Environments to enhance candidate learning. Industrial visits are also highly recommended to consolidate learning in the classroom/laboratory/workshop. By their very nature engineering courses require the transfer of technical knowledge and skills from one area to another. For example, candidates may need to apply electrical or mechanical principles learnt in a restricted core Unit to an engineering problem in a specialist Unit. Similarly, mathematics knowledge and skills developed in a core Numeracy or Mathematics Unit may be applied within a restricted core or optional Engineering Unit. Although not necessarily defined explicitly in individual units, centres may have opportunities to develop other transferable skills as a part of the delivery and assessment of a National Certificate in Engineering programme of study. For example, there may be opportunities, particularly in level 6 awards, to develop candidates' analytical skills while, for example, breaking down an engineering system in terms of the construction and operation of individual parts of the system. Planning skills may be developed while making preparations for practical work and when undertaking assignments or projects. Practical and project work may also provide candidates with opportunities to develop their evaluative skills. Opportunities to develop employability skills may be incorporated within the delivery of National Certificates in Engineering. For example, centres may take the opportunity, if only formatively, to assess such skills as time keeping, listening to instructions, checking own work, working with others etc.

3.5 Target groups

National Certificates in Engineering at SCQF level 5

National Certificates in Engineering at SCQF level 5 may be studied by school leavers, adult returners and those in employment who are seeking a qualification which will educate and train them to become skilled crafts persons/trades persons, maintenance fitters or operatives. Individual units within the level 5 awards can be offered on a free-standing basis to meet specific education or training requirements (eg Computer Aided Draughting for Engineers at SCQF level 5, Maintenance Safety at SCQF level 5 etc.)

National Certificates in Engineering at SCQF level 6

National Certificates in Engineering at SCQF level 6 may be studied by school leavers, adult returners and those in employment who are seeking a qualification which will educate and train them to become engineering technicians. Individual units within the level 6 awards can be offered on a free-standing basis to meet specific industrial education or training requirements (eg Computer Aided Draughting for Engineers at SCQF level 6, Applications of Programmable Logic Controllers at SCQF level 6 etc.)

3.6 Employment opportunities

National Certificates in Engineering at SCQF level 5

As noted in section 2.4 and above, these qualifications provide much of the underpinning knowledge, understanding and skills for candidates who are seeking employment as engineering craftpersons/tradespersons, maintenance fitters or operatives. Such employment opportunities arise frequently in both private business and in the public sector.

National Certificates in Engineering at SCQF level 6

As noted in section 2.4 and above, these qualifications provide much of the underpinning knowledge, understanding and skills for those candidates who are seeking employment as engineering technicians. Employment opportunities for engineering technicians occur regularly in both private business and the public sector.

4 Access to the Group Award(s)

4.1 Access requirements

Admission to any of the National Certificates in Engineering should be based on a broad approach to candidate selection but, at the same time, should ensure that candidates are chosen who have the potential and ability to complete an award successfully. The following are simply recommendations and should not be seen as a definitive or prescriptive list of entry requirements. Their purpose is simply to give guidance on the selection of candidates.

National Certificates in Engineering at SCQF level 5

- At the discretion of the Principal of the presenting centre for applicants with a different experiential background who could benefit from taking the course or units within the course, eg adult returners, overseas students with relevant work experience.
- Mathematics Standard Grade at General level
- Mathematics at Intermediate 1
- Physics Standard Grade at General level
- Physics at Intermediate 1
- Technological Studies Standard Grade at General level
- Technological Studies at Intermediate 1
- Skills for Work Engineering at Intermediate 1

National Certificates in Engineering at SCQF level 6

- At the discretion of the Principal of the presenting centre for applicants with a different experiential background who could benefit from taking the course or units within the course, eg adult returners, overseas students with relevant work experience
- The corresponding National Certificate in Engineering at SCQF level 5 (eg to access the National Certificate in Fabrication and Welding Engineering at SCQF level 6 a candidate may have successfully completed the National Certificate in Fabrication and Welding Engineering at SCQF level 5)
- Mathematics Standard Grade at Credit level
- Mathematics at Intermediate 2
- Physics Standard Grade at Credit level
- Physics at Intermediate 2
- Technological Studies Standard Grade at Credit level
- Technological Studies at Intermediate 2
- Electronic and Electrical Fundamentals at Intermediate 2
- Electrical Installation Fundamentals at Intermediate 2
- Skills for Work in Engineering at Intermediate 2
- SPA in Engineering at Intermediate 2

4.2 Core Skills entry profile

The recommended Core Skills entry profile for National Certificates in Engineering at SCQF level 5 is as follows**:**

♦ *Communication*	Intermediate 1
♦ *Numeracy*	Intermediate 1
♦ *Information and Communication Technology*	Intermediate 1
♦ *Problem Solving*	Intermediate 1
♦ *Working with Others*	Access 3

The recommended Core Skills entry profile for National Certificates in Engineering at SCQF level 6 is as follows:

- *Communication* Intermediate 2
- *Numeracy* Intermediate 2
- *Information and Communication Technology* Intermediate 2
- *Problem Solving* Intermediate 2
- *Working with Others* Intermediate 1

4.3 Alternative Access Arrangements

The presenting centre may operate alternative access arrangements in cases where the candidate is convinced that he/she already has the required competences in a given area. These arrangements are as follows:

- Assessment on demand
- Credit transfer
- Accreditation of prior learning
- Relevant work experience

Individual presenting centres will require to outline their systems for each of these as a part of any approval procedure.

5 Group Award(s) structure

5.1 Overview of the structures of the NQGA in Engineering awards

The structures of the National Certificates in Engineering at SCQF levels 5 and 6 are best explained in terms of the block diagrams shown in Figures 5.1(a) and Figure 5.1(b).

With reference to Figures 5.1(a) and Figure 5.1(b) the following should be noted:

- Award structures at both SCQF levels 5 and 6 comprise of a 3 credit mandatory core, a 5 credit restricted core and a 4 credit optional section
- The Communication, Mathematics and Information Technology units in the mandatory core sections are at the same SCQF level as the level of the award
- The units in the restricted core sections are at the same SCQF level as the level of the award. There are two exceptions to this. The National Certificate in Fabrication and Welding Engineering at SCQF level 5 includes one Unit at SCQF level 6 in the restricted core and the National Certificate in Aeronautical Engineering at SCQF level 6 includes two units at SCQF level 5 in its restricted core section. The inclusion of these units in the two restricted cores was agreed by the respective sub-groups of the QDT and was based on sound market research evidence.
- Units in the Optional Sections can be at SCQF levels 5 or 6

5.2 Satisfying the SQA NQGA Design Principles

It can be seen from studying the two block diagrams that the National Certificates in Engineering at SCQF levels 5 and 6 satisfy the SQA National Qualification Group Award Design Principles. To confirm this consider Figure 5.1(a). To achieve a National Certificate in Engineering at SCQF level 5 a candidate must successfully complete 12 Unit credits at either SCQF level 5 or 6. Twelve Unit credits at SCQF level 5 or 6 are equivalent to 72 SCQF credit points. Furthermore, each National Certificate in Engineering at SCQF level 5 has a mandatory section that is greater than 36 SCQF credit points (it is actually 48 credit points). In addition, more than half of the Units passed by a candidate successfully completing a National Certificate in Engineering at SCQF level 5 will be at SCQF level 5.

Exactly the same applies to a National Certificate in Engineering at SCQF level 6. A candidate must complete 12 units or 72 SCQF credit points to successfully achieve a National Certificate in Engineering at SCQF level 6. Each National Certificate in Engineering qualification at SCQF level 6 has a mandatory core that is greater than 36 SCQF credit points (it is 48 credit points) and more than half of the units passed by a candidate successfully completing a National Certificate at SCQF level 6 qualification will be at SCQF level 6.

Figure 5.1(a) — NC in Engineering: Block Diagram of SCQF level 5 Awards

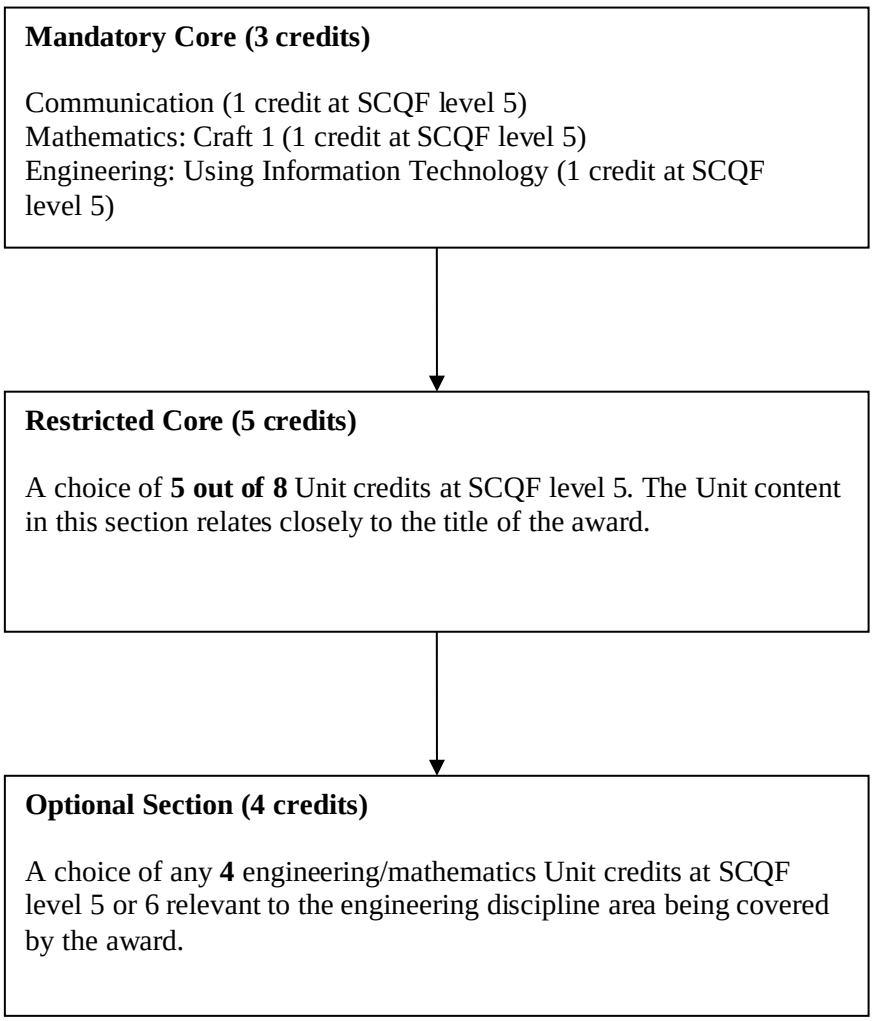
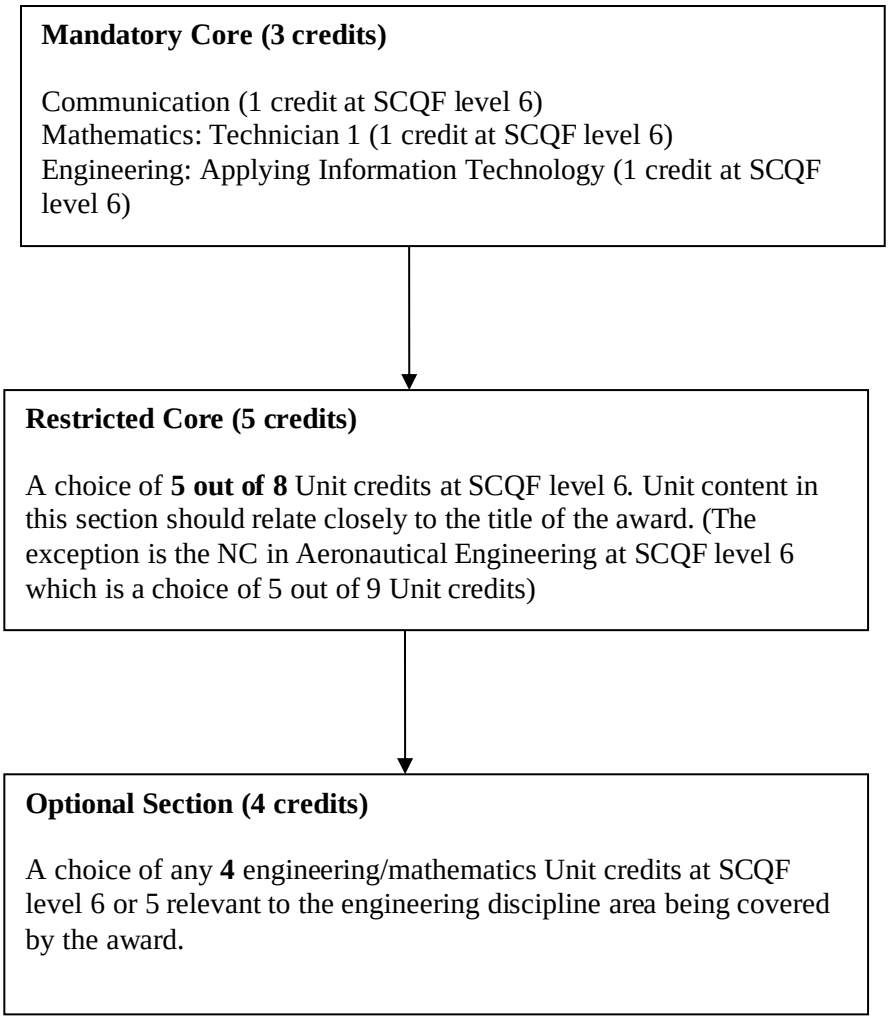


Figure 5.1(b) — NC in Engineering: Block Diagram of SCQF level 6 Awards



5.3 Frameworks

Table 5.3.1 — National Certificate in Electrical Engineering at SCQF level 5

Group Award: G988 45 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	5	F3GB 11	Communication Core Skill Unit
		or	
1	5	H23W 75	Literacy
1	5	F3HV 11	Mathematics: Craft 1
1	5	F5D6 11	Engineering: Using Information Technology

Restricted Core (5 out of 8 credits)

1	5	F5HK 11	Electrical Principles (Mandatory)
1	5	F5D7 11	Fundamental Electrical Systems (Mandatory)
1	5	F5HM 11	Electrical Testing and Measurement (Mandatory)
			Any 2 from 5 credits
1	5	F5HP 11	Electrical Wiring Skills
1	5	F5HE 11	Earthing Systems
1	5	F5JK 11	Rotating Electrical Machines
1	5	F5JL 11	Safe Working Practices
1	5	F5HH 11	Electrical Plant Safety and Maintenance

Optional Section (4 credits)

1	5	F5HP 11	Electrical Wiring Skills
1	5	F5HE 11	Earthing Systems
1	5	F5JK 11	Rotating Electrical Machines
1	5	F5JL 11	Safe Working Practices
1	5	F5HH 11	Electrical Plant Safety and Maintenance
1	5	F5DE 11	Engineering Project
1	5	F5DH 11	Fundamental Electronics
1	5	F5DC 11	Electronic Test Equipment and Measurement
1	5	F5H7 11	Circuit Element Devices
1	5	F5JM 11	Security, Alarm and Communication Systems
1	5	F5HW 11	Installation of PVC Sheathed Wiring Systems
1	5	F5FX 11	Installation of Conduit Systems
1	5	F5HY 11	Installation of Trunking Systems
1	5	F5FV 11	Installation of Cable Tray and MI Systems
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	5	F5HR 11	Electricity in the Home
1	5	F5FS 11	Inspection and Testing of Electrical Installations
1	5	F5JY 11	Transformation and Rectification

1	5	F3HW 11	Mathematics: Craft 2
1	6	F3HX 12	Mathematics: Technician 1
1	5	J12W 75	Energy: An Introduction
0.5	5	J132 75	Energy: Conventional Technologies and the Grid
0.5	5	J12X 75	Energy: Employability and Careers

Table 5.3.2 — National Certificate in Electronic Engineering at SCQF level 5

Group Award: G98D 45 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	5	F3GB 11	Communication Core Skill Unit
		or	
1	5	H23W 75	Literacy
1	5	F3HV 11	Mathematics: Craft 1
1	5	F5D6 11	Engineering: Using Information Technology

Restricted Core (5 out of 8 credits)

1	5	F5HK 11	Electrical Principles (Mandatory)
1	5	F5DH 11	Fundamental Electronics (Mandatory)
1	5	F5DC 11	Electronic Test Equipment and Measurement (Mandatory)
			Any 2 from 5 credits
1	5	F5JW 11	Soldering and Circuit Assembly Techniques
1	5	F5JN 11	Semiconductor Applications
1	5	F5HA 11	Combinational Logic
1	5	F5HS 11	Electronic Simulation and Testing
1	5	F5JJ 11	Practical Electronics

Optional Section (4 credits)

1	5	F5JW 11	Soldering and Circuit Assembly Techniques
1	5	F5JN 11	Semiconductor Applications
1	5	F5HA 11	Combinational Logic
1	5	F5HS 11	Electronic Simulation and Testing
1	5	F5JJ 11	Practical Electronics
1	5	F5DE 11	Engineering Project
1	5	F5H7 11	Circuit Element Devices
1	5	F5JR 11	Sequential Logic
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	5	F5D7 11	Fundamental Electrical Systems
1	5	F5HM 11	Electrical Testing and Measurement
1	5	F5JY 11	Transformation and Rectification
1	6	F3HX 12	Mathematics: Technician 1
1	5	F3HW 11	Mathematics: Craft 2
1	5	F5H4 11	Computer Aided Draughting (CAD) for Engineers
1	5	F5DG 11	Health and safety: Engineering

Table 5.3.3 — National Certificate in Fabrication and Welding Engineering at SCQF level 5

Group Award: G981 45 **12 credits**

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	5	F3GB 11	Communication Core Skill Unit
		or	
1	5	H23W 75	Literacy
1	5	F3HV 11	Mathematics: Craft 1
1	5	F5D6 11	Engineering: Using Information Technology

Restricted Core (5 out of 8 credits)

1	5	F5EW 11	Fabrication Processes (Mandatory)
1	5	F5F3 11	Welding Processes (Mandatory)
1	5	F5DG 11	Health and Safety: Engineering (Mandatory)
			Any 2 from 5 credits
1	5	F5W9 11	Engineering Materials
1	5	F5DE 11	Engineering Project
1	6	F5F7 12	Metal Inert Gas (MIG) Metal Active Gas (MAG) Welding Skills
1	5	F5EX 11	Pattern Development
1	5	F5F1 11	Thermal Cutting Skills

Optional Section (4 credits)

1	5	F5W9 11	Engineering Materials
1	5	F5DE 11	Engineering Project
1	6	F5F7 12	Metal Inert Gas (MIG) Metal Active Gas (MAG) Welding Skills
1	5	F5EX11	Pattern Development
1	5	F5F1 11	Thermal Cutting Skills
1	5	F5H4 11	Computer Aided Draughting (CAD) for Engineers
2	5	F5FG 11	Fabrication Skills
1	5	F5FP 11	Graphical Engineering Communication
1	5	F3HW 11	Mathematics: Craft 2
1	6	F5F6 12	Manuel Metal Arc (MMA) Welding Skills
1	5	F5EY 11	Pipework Skills
1	5	F5F0 11	Ship Construction Skills
1	5	F5F2 11	Thermal Joining Skills
1	6	F5FC 12	Tungsten Inert Gas (TIG) Welding Skills
1	5	F5F4 11	Weld Procedure Specification and Testing

Table 5.3.4 — National Certificate in Mechanical Maintenance Engineering at SCQF level 5

Group Award: G983 45 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	5	F3GB 11	Communication Core Skill Unit
		Or	
1	5	H23W 75	Literacy
1	5	F3HV 11	Mathematics: Craft 1
1	5	F5D6 11	Engineering: Using Information Technology

Restricted Core (5 out of 8 credits)

1	5	F5K1 11	Mechanical Engineering Principles
1	5	F5HH 11	Electrical Plant Safety and Maintenance
1	5	F5J4 11	Maintenance Safety
1	5	F5J2 11	Plant Installation
1	5	F5J3 11	Plant Maintenance Practice
1	5	F5K2 11	Pneumatics and Hydraulics
1	5	F5K3 11	Power Drives
1	5	F5FP 11	Graphical Engineering Communication

Optional Section (4 credits)

1	5	F5K1 11	Mechanical Engineering Principles
1	5	F5HH 11	Electrical Plant Safety and Maintenance
1	5	F5J4 11	Maintenance Safety
1	5	F5J2 11	Plant Installation
1	5	F5J3 11	Plant Maintenance Practice
1	5	F5K2 11	Pneumatics and Hydraulics
1	5	F5K3 11	Power Drives
1	5	F5H4 11	Computer Aided Draughting (CAD) for Engineers
1	5	F5W7 11	Engineering Dimensional Control
1	5	F5W9 11	Engineering Materials
1	5	F5DE 11	Engineering Project
1	5	F5FP 11	Graphical Engineering Communication
1	5	F5DG 11	Health and Safety: Engineering
1	5	F3HW 11	Mathematics: Craft 2
1	5	F5K4 11	Engineering Prime Movers

Table 5.3.5 — National Certificate in Manufacturing Engineering at SCQF level 5

Group Award: G982 45 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	5	F3GB 11	Communication Core Skill Unit
		or	
1	5	H23W 75	Literacy
1	5	F3HV 11	Mathematics: Craft 1
1	5	F5D6 11	Engineering: Using Information Technology

Restricted Core (5 out of 8 credits)

1	5	F5H4 11	Computer Aided Draughting (CAD) for Engineers
1	5	F5W7 11	Engineering Dimensional Control
1	5	F5W9 11	Engineering Materials
1	5	F5WD 11	Engineering Material Removal Principles
1	5	F5W8 11	Engineering Manufacturing Processes
1	5	F5WA 11	Engineering Workshop Skills
1	5	F5D9 11	Industrial CNC Machining
1	5	F5FP 11	Graphical Engineering Communication

Optional Section (4 credits)

1	5	F5W6 11	Engineering Assembly Skills
1	5	F5W7 11	Engineering Dimensional Control
1	5	F5W8 11	Engineering Manufacturing Processes
1	5	F5WA 11	Engineering Workshop Skills
1	5	F5D9 11	Industrial CNC Machining
1	5	F5WD 11	Engineering Material Removal Principles
1	5	F5WB 11	Material Removal Practice: Milling
1	5	F5WC 11	Material Removal Practice: Turning
1	5	F5H4 11	Computer Aided Draughting (CAD) for Engineers
1	5	F5W9 11	Engineering Materials
1	5	F5DE 11	Engineering Project
1	5	F5FP 11	Graphical Engineering Communication
1	5	F5DG 11	Health and Safety: Engineering
1	5	F3HW 11	Mathematics: Craft 2
1	6	F3HX 12	Mathematics: Technicians 1
1	6	F5H6 12	Robotic and Automated Systems
1	6	F5FM 12	Engineering Quality: An Introduction
1	5	F5K1 11	Mechanical Engineering Principles

Table 5.3.6 — National Certificate in Aeronautical Engineering at SCQF level 6

Group Award: G97H 46 **12 credits**

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5GM 12	Aeronautical Engineering Fundamentals (Mandatory)
1	6	F5GR 12	Aircraft Systems (Mandatory)
			Any 3 from 7 credits
1	6	F5GV 12	Aircraft Flight Controls
1	6	F5GW 12	Aircraft Hydraulic and Pneumatic Systems
1	5	F5GP 11	Aircraft Maintenance
1	6	F5GX 12	Aircraft Power Plant
2	5	F5H2 11	Aviation Practice
1	6	F5GS 12	Avionics: An Introduction

Optional Section (4 credits)

1	6	F5GV 12	Aircraft Flight Controls
1	6	F5GW 12	Aircraft Hydraulic and Pneumatic Systems
1	5	F5GP 11	Aircraft Maintenance
1	6	F5GX 12	Aircraft Power Plant
2	5	F5H2 11	Aviation Practice
1	6	F5GS 12	Avionics: An Introduction
1	5	F5D2 11	Aeronautical Electrical Technology
1	5	F5GN 12	Aircraft Design: An Introduction
1	6	F5GT 12	Theory of Flight
1	6	F5K6 12	Engineering Dynamics: An Introduction
1	6	F5KD12	Engineering Materials
1	6	F5FM 12	Engineering Quality: An Introduction
1	6	F3HY 12	Mathematics: Technician 2
1	6	F5K9 12	Strength of Materials
1	6	F5D5 12	Engineering Project

Table 5.3.7 — National Certificate in Electrical Engineering at SCQF level 6

Group Award: G9AF 46 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5HL 12	Electrical Principles (Mandatory)
1	6	F5D8 12	Fundamental Electrical Systems (Mandatory)
1	6	F5HN 12	Electrical Testing and Measurement (Mandatory)
			Any 2 from 5 credits
1	6	F5FT 12	Inspection and Testing of Electrical Installations
1	6	F5HG 12	Electrical Plant Maintenance
1	6	F5JT 12	Single and Three Phase Induction Motors
1	6	F5H3 12	Cable Ratings and Overcurrent Protection Devices
1	6	F5HD 12	Earthing and Earth Fault Current Protection

Optional Section (4 credits)

1	6	F5FT 12	Inspection and Testing of Electrical Installations
1	6	F5HG 12	Electrical Plant Maintenance
1	6	F5JT 12	Single and Three Phase Induction Motors
1	6	F5H3 12	Cable Ratings and Overcurrent Protection Devices
1	6	F5HD 12	Earthing and Earth Fault Current Protection
1	6	F5D5 12	Engineering Project
1	6	F5DB 12	Fundamental Electronics
1	6	F5DJ 12	Electronic Test Equipment and Measurement
1	6	F5H8 12	Circuit Element Principles
1	5	F5HP 11	Electrical Wiring Skills
1	6	F5FY 12	Installation of Conduit Systems
1	6	F5J0 12	Installation of Trunking Systems
1	6	F5FW 12	Installation of Cable Tray and MI Systems
1	6	F5HX 12	Installation of PVC Sheathed Wiring Systems
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	5	F5JY 11	Transformation and Rectification
1	6	F5D3 12	Electrostatics and Electromagnetics
1	6	F5J7 12	Electronic Network Analysis
1	6	F5J1 12	Low Voltage Distribution Systems
1	6	F5HF 12	Electrical Installations in Hazardous Environments and Special Locations
1	6	F5FR 12	Illumination and Emergency Lighting

1	6	F5K0 12	Transformers
1	6	F5HC 12	Direct Current Machines
1	6	F5HJ 12	Electrical Power Systems
		F5HB 12	Digitally Integrated Security and Environmental Control Systems
1	6	F5JV 12	Single Phase and Three Phase Principles
1	6	F5JH 12	Power Electronics
1	5	F5JL 11	Safe Working Practices
1	6	F5JX 12	Switchgear and High Voltage Protection
1	6	F5DF 12	Fault Finding on Low Voltage Electrical Systems and Equipment
1	6	F5GY 12	Alarm and Communication Systems
1	6	F5DA 12	Installation of AC Induction Motors
1	6	F3HY 12	Mathematics: Technician 2
1	5	F5HA 11	Combinational Logic
1	6	F5JP 12	Semiconductor Applications
1	6	F5FM 12	Engineering Quality: An Introduction
1	6	F5FA 12	Shipbuilding Technology

Table 5.3.8 — National Certificate in Electronic Engineering at SCQF level 6

Group Award: G9AG 46 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5HL 12	Electrical Principles (Mandatory)
1	6	F5DB 12	Fundamental Electronics (Mandatory)
1	6	F5DJ 12	Electronic Test Equipment and Measurement (Mandatory)
			Any 2 from 5 credits
1	6	F5J6 12	Operational Amplifiers
1	6	F5J7 12	Electronic Network Analysis
1	6	F5JP 12	Semiconductor Applications
1	6	F5H9 12	Combinational Logic
1	6	F5J5 12	Power Supplies

Optional Section (4 credits)

1	6	F5J6 12	Operational Amplifiers
1	6	F5J7 12	Electronic Network Analysis
1	6	F5JP 12	Semiconductor Applications
1	6	F5H9 12	Combinational Logic
1	6	F5J5 12	Power Supplies
1	6	F5D5 12	Engineering Project
1	5	F5H7 11	Circuit Element Devices
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	5	F5JY 11	Transformation and Rectification
1	6	F5D3 12	Electrostatics and Electromagnetics
1	6	F5JS 12	Sequential Logic
1	6	F5JH 12	Power Electronics
1	6	F5D8 12	Fundamental Electrical Systems
1	6	F5HN 12	Electrical Testing and Measurement
1	6	F3HY 12	Mathematics: Technician 2

Table 5.3.9 — National Certificate in Fabrication and Welding Engineering at SCQF level 6

Group Award: G984 46 **12 credits**

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5F5 12	Fabrication Processes (Mandatory)
1	6	F5FD 12	Welding Processes (Mandatory)
			Any 3 from 6 credits
1	6	F5KD 12	Engineering Materials
1	6	F5D5 12	Engineering Project
1	6	F5JG 12	Graphical Engineering Communication
1	6	F5F8 12	Pattern Development
1	6	F5FB 12	Thermal Cutting Processes
1	6	F5FE 12	Weld Procedure Specification and Testing

Optional Section (4 credits)

1	6	F5KD 12	Engineering Materials
1	6	F5D5 12	Engineering Project
1	6	F5JG 12	Graphical Engineering Communication
1	6	F5F8 12	Pattern Development
1	6	F5FB 12	Thermal Cutting Processes
1	6	F5FE 12	Weld Procedure Specification and Testing
1	6	F5H5 12	Computer Aided Draughting (CAD) for Engineers
1	6	F5FM 12	Engineering Quality: An Introduction
1	5	F5DG 11	Health and Safety: Engineering
1	6	F3HY 12	Mathematics: Technician 2
1	6	F5F9 12	Pipework Systems
1	6	F5FA 12	Shipbuilding Technology
1	6	F5FF 12	Welding Effects on the Structure of Materials
1	6	F5F7 12	Metal Inert Gas(MIG)Metal Active Gas(MAG) Welding Skills
1	6	F5FC 12	Tungsten Inert Gas(TIG) Welding Skills
1	6	F5F6 12	Manual Metal Arc (MMA) Welding Skills

Table 5.3.10 — National Certificate in Manufacturing Engineering at SCQF level 6

Group Award: G97L 46 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5H5 12	Computer Aided Draughting (CAD) for Engineers
1	6	F5KB 12	Engineering Dimensional Control
1	6	F5KC 12	Engineering Manufacturing Processes
1	6	F5KD 12	Engineering Materials
1	6	F5KE 12	Engineering Workshop Skills
1	6	F5HT 12	Industrial CNC Machining
1	6	F5KH 12	Engineering Material Removal Principles
1	6	F5JG 12	Graphical Engineering Communication

Optional Section (4 credits)

1	6	F5KA 12	Engineering Assembly Skills
1	6	F5KB 12	Engineering Dimensional Control
1	6	F5KC 12	Engineering Manufacturing Processes
1	6	F5KE 12	Engineering Workshop Skills
1	6	F5HT 12	Industrial CNC Machining
1	6	F5KH 12	Engineering Material Removal Principles
1	6	F5KF 12	Material Removal Practice: Milling
1	6	F5KG 12	Material Removal Practice: Turning
1	6	F5HO 12	Applications of Programmable Logic Controllers
1	6	F5H5 12	Computer Aided Draughting (CAD) for Engineers
1	6	F5KD 12	Engineering Materials
1	6	F5D5 12	Engineering Project
1	6	F5FM 12	Engineering Quality: An Introduction
1	6	F5FN 12	Engineering Systems
1	6	F5JG 12	Graphical Engineering Communication
1	6	F5HV 12	Industrial CNC Part Programming
1	6	F3HY 12	Mathematics: Technician 2
1	6	F5H6 12	Robotic and Automated Systems
1	6	F5K5 12	Engineering Design
1	5	F5K1 11	Mechanical Engineering Principles
1	5	F5DG 11	Health & Safety

Table 5.3.11 — National Certificate in Measurement and Control Engineering at SCQF level 6

Group Award: G987 46 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5KR 12	Engineering: Measurement Technology — Flow
1	6	F5KT 12	Engineering: Measurement Technology — Pressure/level
1	6	F5KS 12	Engineering: Measurement Technology — Temperature
1	6	F5KK 12	Engineering: Process Control
1	6	F5KW 12	Engineering: Process Control Systems
1	6	F5KM 12	Engineering: Distributed Control Systems
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	6	F5KX 12	Engineering: Signal Conditioning in Telemetry

Optional Section (4 credits)

1	6	F5KR 12	Engineering: Measurement Technology — Flow
1	6	F5KT 12	Engineering: Measurement Technology — Pressure/level
1	6	F5KS 12	Engineering: Measurement Technology — Temperature
1	6	F5KK 12	Engineering: Process Control
1	6	F5KW 12	Engineering: Process Control Systems
1	6	F5KM 12	Engineering: Distributed Control Systems
1	6	F5H0 12	Applications of Programmable Logic Controllers
1	6	F5KX 12	Engineering: Signal Conditioning in Telemetry
1	6	F5KJ 12	Engineering: Complex Control Systems
1	6	F5KV 12	Engineering: Process Analysers
1	6	F5H9 12	Combinational Logic
1	6	F5HL 12	Electrical Principles
1	6	F5KP 12	Engineering: Hazards, Protection Methods and Functional Safety
1	6	F5KN 12	Engineering: Fault Finding in Measurement and Control
1	6	F5KL 12	Engineering: Control Valves and Positioners
1	6	F3HY 12	Mathematics: Technician 2
1	6	F5H6 12	Robotic and Automated Systems

Table 5.3.12 — National Certificate in Mechanical Engineering at SCQF level 6

Group Award: G97J 46 12 credits

Mandatory Core (3 credits)

Credit value	SCQF level	Product code	Product title
1	6	F3GB 12	Communication Core Skill Unit
1	6	F3HX 12	Mathematics: Technician 1
1	6	F5D4 12	Engineering: Applying Information Technology

Restricted Core (5 out of 8 credits)

1	6	F5K8 12	Statics (Mandatory)
1	6	F5K6 12	Engineering Dynamics: An Introduction (Mandatory)
1	6	F5JE 12	Thermofluids (Mandatory)
			Any 2 from 5 credits
1	6	F5K9 12	Strength of Materials
1	6	F5K7 12	Engineering Dynamics
1	6	F5JF 12	Engineering Thermodynamics
1	6	F5JB 12	Pneumatics and Hydraulics
1	6	F5JC 12	Power Drives

Optional Section (4 credits)

1	6	F5K9 12	Strength of Materials
1	6	F5K7 12	Engineering Dynamics
1	6	F5JF 12	Engineering Thermodynamics
1	6	F5JB 12	Pneumatics and Hydraulics
1	6	F5JC 12	Power Drives
1	6	F5H5 12	Computer Aided Draughting (CAD) for Engineers
1	6	F5K5 12	Engineering Design
1	6	F5HG 12	Electrical Plant Maintenance
1	6	F5KB 12	Engineering Dimensional Control
1	6	F5KD 12	Engineering Materials
1	6	F5D5 12	Engineering Project
1	6	F5FM 12	Engineering Quality: An Introduction
1	6	F5FN 12	Engineering Systems
1	6	F5JG 12	Graphical Engineering Communication
1	6	F3HY 12	Mathematics: Technician 2
1	6	F5JA 12	Maintenance Safety
1	6	F5J8 12	Plant Installation
1	6	F5J9 12	Plant Maintenance Practice
1	6	F5JD 12	Engineering Prime Movers
1	6	F5F9 12	Pipework Systems
1	6	F5FA 12	Shipbuilding Technology

5.4 Conditions of the Award

The conditions of award for the National Certificate in Engineering qualifications are as follows:

To achieve a **National Certificate in Electrical Engineering at SCQF level 5** a candidate must pass the following Units shown in Table 5.3.1:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Electrical Principles, Fundamental Electrical Systems and Electrical Testing and Measurement.
- Four Unit credits from the optional section

To achieve a **National Certificate in Electronic Engineering at SCQF level 5** a candidate must pass the following units shown in Table 5.3.2:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Electrical Principles, Fundamental Electronics and Electronic Test Equipment and Measurement
- Four Unit credits from the optional section

To achieve a **National Certificate in Fabrication and Welding Engineering at SCQF level 5** a candidate must pass the following units shown in Table 5.3.3:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Fabrication Processes, Welding Processes and Health and Safety: Engineering
- Four Unit credits from the optional section.

To achieve a **National Certificate in Mechanical Maintenance Engineering at SCQF level 5** a candidate must pass the following units shown in Table 5.3.4:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section
- Four Unit credits from the optional section

To achieve a **National Certificate in Manufacturing Engineering at SCQF level 5** a candidate must pass the following units shown in Table 5.3.5:

- The three Unit credits in the mandatory core section;
- Five Unit credits from the restricted core section
- Four Unit credits from the optional section

To achieve a **National Certificate in Aeronautical Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.6:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Aeronautical Engineering Fundamentals and Aircraft Systems
- Four Unit credits from the optional section

To achieve a **National Certificate in Electrical Engineering at SCQF level 6** a candidate must pass the following units shown in Table 5.3.7:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Electrical Principles, Fundamental Electrical Systems and Electrical Testing and Measurement
- Four Unit credits from the optional section

To achieve a **National Certificate in Electronic Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.8:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units: Electrical Principles, Fundamental Electronics and Electronic Test Equipment and Measurement
- Four Unit credits from the optional section

To achieve a **National Certificate in Fabrication and Welding Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.9:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following units; Fabrication Processes and Welding Processes
- Four Unit credits from the optional section

To achieve a **National Certificate in Manufacturing Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.10:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section
- Four Unit credits from the optional section

To achieve a **National Certificate in Measurement and Control Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.11:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section
- Four Unit credits from the optional section

To achieve a **National Certificate in Mechanical Engineering at SCQF level 6** a candidate must pass the following Units shown in Table 5.3.12:

- The three Unit credits in the mandatory core section
- Five Unit credits from the restricted core section which must include the following Units; *Statics, Engineering Dynamics: An Introduction and Thermofluids*
- Four Unit credits from the optional section

5.5 Core Skills

Core Skills Exit Profile

National Certificates in Engineering at SCQF level 5

The minimum Core Skills exit profile for all National Certificates in Engineering at SCQF level 5 is as follows:

Communication at SCQF level 5 — F3GB 11: the *Communication* Core Skills Unit at SCQF level 5 is one of the three units in the mandatory core section of all the National Certificates in Engineering at SCQF level 5.

Using Number Core Skill component at SCQF level 5 is embedded in the mandatory Unit *F3HV 11: Mathematics: Craft 1.*

Information and Communication Technology at SCQF level 5 is embedded in the mandatory Unit *F5D6 11: Engineering: Using Information Technology.*

National Certificates in Engineering at SCQF level 6

The minimum Core Skills Exit Profile for all National Certificates in Engineering at SCQF level 6 is as follows:

Communication at SCQF level 6 — F3GB 12: the *Communication* Core Skills Unit at SCQF level 6 is one of the three units in the Mandatory Core Section of the National Certificates in Engineering at SCQF level 6.

Numeracy at SCQF level 6 is embedded in the Mandatory Unit *F3HX 12: Mathematics: Technician 1.*

Information and Communication Technology at SCQF level 6 is embedded in the mandatory Unit *F5D4 12: Engineering: Applying Information Technology.*

Six other Units within the National Certificates in Engineering have been audited for Core Skills and the following Core Skill components have been found to be embedded in them:

The Unit *F3HW 11: Mathematics: Craft 2* has the Using Number Core Skill component at SCQF level 5 embedded in it and the Unit F3HY 12: Mathematics: Technician 2 has the Using Number Core Skill component Using Number at SCQF level 6 embedded in it.

The units *F5FP 11: Graphical Engineering Communication* at SCQF level 5 and *F5JG 12: Graphical Engineering Communication* at SCQF level 6 both have the Core Skills component Using Graphical Information at SCQF level 5 embedded in them.

The units *F5DE 11: Engineering Project* at SCQF level 5 and *F5D5 12: Engineering Project* at SCQF level 6 have the Core Skill component Planning and Organising at SCQF level 5 and SCQF level 6 respectively embedded in them.

A Core Skill signposting exercise has been carried out for all the twelve National Certificate in Engineering awards. Details of this exercise can be found in Appendix 1.

5.6 Mapping information

An indication of the ways in which the units in the National Certificates in Engineering awards map into the aims of the qualifications is given in Section 3.3.

There are currently over two thousand National Occupational Standards available across different Sector Skills Councils to which the 12 National Certificates in Engineering may be mapped. Mapping such a large number of Standards is a very large, resource intensive project. Given the size of this project and with some of the Standards currently under review, it has not been possible to do a full mapping. Appendix 2 contains examples of mapping between the National Certificate in Engineering awards and National Occupational Standards to illustrate how a mapping process may be conducted.

5.7 Articulation and professional recognition

The National Certificate in Engineering awards have been designed to allow candidates to articulate to the corresponding modernised HNC and HND awards in Engineering. Table 5.7.1 shows the articulation arrangements between the new National Certificates in Engineering and HNCs and HNDs in Engineering.

The Institution of Engineering and Technology (IET) has advised that the National Certificates in Engineering at SCQF levels 5 and 6 only partially meet the academic requirements for registration as an Engineering Technician. A minimum of an HNC or HND in Engineering is required to meet the full academic requirements.

The Institution of Mechanical Engineers (IMechE) has indicated that the National Certificates in Engineering awards at SCQF level 6 meet their academic requirements for Engineering Technician status.

The National Certificates in Engineering at both SCQF levels 5 and 6 may be delivered to candidates on a full-time basis in combination with suitable Vocational Qualification (VQ), such as Performing Engineering Operations at levels 1 and 2 (SCQF levels 4 and 5), to allow candidates to gain a wide range of skills and knowledge in engineering. They may also be delivered to candidates in employment doing a VQ as a means of providing underpinning knowledge and skills for the VQ.

Table 5.7.1 — Articulation Arrangements between the new NCs in Engineering and HNC/HND Engineering qualifications

New NC in Engineering	Advanced Certificate/HNC/HND Awards
National Certificate in Electrical Engineering at SCQF level 5	Advanced Certificate in Electrical Engineering and HNC Engineering Practice
National Certificate in Electronic Engineering at SCQF level 5	Advanced Certificate in Electrical Engineering and HNC Engineering Practice
National Certificate in Fabrication and Welding Engineering at SCQF level 5	Advanced Certificate in Fabrication and Welding and HNC Engineering Practice
National Certificate in Maintenance Engineering at SCQF level 5	Advanced Certificate in Engineering Maintenance and HNC Engineering Practice
National Certificate in Manufacturing Engineering at SCQF level 5	Advanced Certificate in Engineering Manufacture and HNC Engineering Practice
National Certificate in Aeronautical Engineering at SCQF level 6	HNC and HND Aircraft Engineering
National Certificate in Electrical Engineering at SCQF level 6	HNC and HND Electrical Engineering HNC and HND Engineering Systems HNC and HND Mechatronics
National Certificate in Electronic Engineering at SCQF level 6	HNC and HND Electronics HNC and HND Engineering Systems HNC and HND Mechatronics
National Certificate in Fabrication and Welding Engineering at SCQF level 6	HNC and HND Fabrication, Welding and Inspection HNC and HND Engineering Systems
National Certificate in Manufacturing Engineering at SCQF level 6	HNC and HND Manufacturing Engineering HNC and HND Engineering Systems HNC and HND Mechatronics
National Certificate in Measurement and Control Engineering at SCQF level 6	HNC and HND Measurement and Control Engineering
National Certificate in Mechanical Engineering at SCQF level 6	HNC and HND Mechanical Engineering HNC and HND Engineering Systems HNC and HND Mechatronics

6 Approaches to delivery and assessment

6.1 Content and Context

At the outset of this section it is important to clarify the respective roles of National Certificates in Engineering at SCQF level 5 and level 6. National Certificates in Engineering at SCQF level 5 have been designed primarily to meet the education and training needs of those candidates who wish to become skilled crafts persons/trades persons or operatives. However, these National Certificates are also suitable for candidates who have little or no knowledge of engineering but who wish to learn about an engineering discipline. In contrast, National Certificates in Engineering at SCQF level 6 have been designed principally to meet the educational and training needs of those candidates who wish to pursue a career as a technician in an engineering environment.

National Certificates in Engineering at both SCQF levels 5 and 6 have been designed with the following three sections:

- mandatory core
- restricted core
- optional

From the beginning of the developments of the new National Certificates in Engineering market research evidence pointed clearly to the inclusion of three common mandatory units in Communication, Numeracy/Mathematics and Information Technology within each National Certificate. It is important that these mandatory core units are not delivered in isolation but rather their delivery and assessment is integrated fully with the engineering units in the award. For example, experience shows that teaching mathematics within an engineering context helps candidates to grasp more effectively important numerical and mathematical concepts, formulae and problem solving approaches. Likewise Information Technology has more relevance to candidates when it is set within an engineering context. For this reason, the Units Engineering: Using Information Technology at SCQF level 5 and Engineering: Applying Information Technology at SCQF level 6 both have an Outcome where candidates have to use and apply engineering software.

Experience has shown that centres have faced many challenges when delivering and assessing Communication within engineering programmes of study. Candidates struggle to see the relevance of Communication when it is taught in isolation to the rest of an engineering course. This issue has been addressed in the new awards by including the Core Skill Communication Unit at SCQF level 5 in all National Certificates in Engineering at level 5 and the Core Skill Communication Unit at SCQF level 6 within all National Certificates in Engineering at SCQF level 6. In doing this it is hoped that centres will try to deliver and assess the Core Skills in Communication as part of the delivery and assessment of engineering units. For example, an activity within an engineering Unit which requires candidates to engage in group discussions provides lecturers with opportunities not only to develop candidates' technical skills but also their oral communication skills. Likewise report writing in engineering units should provide opportunities to develop important written communication skills.

The restricted core section of each National Certificate in Engineering has been designed to reflect as closely as possible the title of the award and as such it is this section that defines the unique nature of the award. For example, a candidate taking a National Certificate in Manufacturing Engineering at SCQF level 5 will study any five out of eight of the following Units:

- Computer Aided Draughting for Engineers
- Engineering Dimensional Control
- Engineering Manufacturing Processes
- Engineering Materials
- Engineering Workshop Skills
- Industrial CNC Machining
- Engineering Material Removal Principles
- Graphical Engineering Communication

A brief examination of these Unit titles reveals that they are closely related to the subject of Manufacturing Engineering.

The optional sections of the National Certificates in Engineering are designed to allow candidates some degree of flexibility in the choice of units they study as part of their National Certificate programme. Candidates may select units from this section for one or more of the following reasons:

- To specialise further in the engineering discipline defined by the title of the award
- To broaden their knowledge of engineering
- To enhance their knowledge and understanding of Numeracy/Mathematics so that they can progress to more advanced qualifications
- To meet the requirements of their employer
- For career and/or personal development purposes

During the development of the National Certificates in Engineering the QDT recognised the critical importance of incorporating Health and Safety within individual awards. The strategies adopted to achieve this vary from award to award but generally follow one or more of the following approaches:

- Have a dedicated Health and Safety Unit
- Have dedicated Health and Safety Outcomes within units
- Incorporate Health and Safety within Outcomes of units where relevant

Table 6.1 shows how Health and Safety has been incorporated into each of the twelve National Certificates in Engineering.

Table 6.1 National Certificates in Engineering — Health and Safety Matrix

Award title	SCQF level	Health and Safety Content in the award
Electrical Engineering	5	This award contains units in both electrical installation and electrical plant. The Restricted Core contains two units which feature Health and Safety prominently: Safe Working Practices at SCQF level 5 Electrical Plant Safety and Maintenance at SCQF level 5 Health and Safety issues are identified in other units in the Restricted Core and Optional Section as appropriate. For example, in the Electrical Wiring Skills SCQF level 5 Unit candidates must undertake all electrical wiring work and inspection and testing in a safe and correct manner. Likewise in the Electrical Testing and Measurement SCQF level 5 Unit candidates must carry out all electrical measurements in a safe and correct manner. The award contains a significant number of practical electrical installation units in the Optional Section in which Health and Safety is embedded in individual Outcomes of the units as appropriate.
Electronic Engineering	5	This award contains an appropriate balance of theory and practical based units in analogue and digital electronics and electrical principles. Health and Safety issues are identified in Unit Outcomes where relevant. For example, safety features in all four Outcomes of the Unit Electronic Test Equipment and Measurement at SCQF level 5. In the Applications of Programmable Logic Controllers (PLC) SCQF level 6 Unit candidates must describe safety considerations when dealing with the control of industrial processes using PLC.

Award title	SCQF level	Health and Safety Content in the award
Fabrication and Welding Engineering	5	Health and Safety is seen as an area of high importance in this award as is evidenced by the inclusion of the Health and Safety: Engineering at SCQF level 5 Unit as mandatory in the Restricted Core of the award. Theory based units highlight issues relevant to Health and Safety where appropriate. The following practical units have dedicated Health and Safety Outcomes: MIG/MAG Welding Skills at SCQF level 6 Thermal Cutting Skills at SCQF level 5 Fabrication Skills at SCQF level 5 Pipefitting Skills at SCQF level 5 Thermal Joining Skills at SCQF level 5 TIG Welding Skills at SCQF level 6 The Ship Construction Skills SCQF level 5 Unit has Health and Safety embedded in individual Outcomes as appropriate.
Mechanical Maintenance Engineering	5	Health and Safety is a critical aspect of modern mechanical plant maintenance and because of this Health and Safety features prominently in award design. A Unit Maintenance Safety at SCQF level 5 is included in the Restricted Core of the award. Applying safety regulations, procedures and practices, good housekeeping and appropriate tool/equipment storage are embedded in appropriate Outcomes in the following Units: Plant Installation at SCQF level 5 Plant Maintenance Practice at SCQF level 5 Pneumatics and Hydraulics at SCQF level 5 Power Drives at SCQF level 5 Prime Movers at SCQF level 5 Electrical Plant Safety and Maintenance at SCQF level 5 Centres wishing to underpin the Health and Safety knowledge and understanding candidates acquire in other units in the award may choose to include the Unit Health and Safety: Engineering at SCQF level 5 in their programme of study.

Award title	SCQF level	Health and Safety Content in the award
Manufacturing Engineering	5	This award has a mixture of theoretical and practical content. Theory based units highlight issues relevant to Health and Safety where appropriate. The following practical units contain a dedicated Health and Safety Outcome: Engineering Assembly Skills at SCQF level 5 Engineering Workshop Skills at SCQF level 5 Materials Removal Practice: Milling at SCQF level 5 Materials Removal Practice: Turning at SCQF level 5 The Unit Industrial CNC Machining at SCQF level 5 has Health and Safety embedded in Outcome 3 where candidates are required to produce given components on an industrial CNC machine in a correct and safe manner. Centres wishing to underpin the Health and Safety knowledge and understanding candidates acquire in other units in the award may choose to include the Unit Health and Safety: Engineering at SCQF level 5 in their programme of study.

Award title	SCQF level	Health and Safety Content in the Award
Aeronautical Engineering	6	This award contains units that are largely theory based. However, practical based units have Health and Safety embedded in them as follows: Aircraft Hydraulics and Pneumatics at SCQF level 6 — Health and Safety is embedded into Outcome 4 where candidates have to construct and test a fluid power circuit correctly and safely. Aircraft Maintenance at SCQF level 5 — Health and Safety is embedded into Outcome 3 where candidates have to carry out aircraft maintenance operations correctly and safely. Emphasis is placed on Health and Safety in the Support Notes of this Unit with the statement ♦ Candidates must demonstrate compliance with all relevant Health and Safety working ♦ procedures and practices while undertaking all practical activities in the Unit Aviation Practice at SCQF level 5 — This Unit has a dedicated Health and Safety Outcome (Outcome 1) and Health and Safety is also embedded in other practical Outcomes as appropriate (eg Outcome 2 — correct and safe use of hand tools and equipment and Outcome 5 — correct and safe manufacture or repair of an artefact).
Electrical Engineering	6	Like the SCQF level 5 Electrical award this award contains units in both electrical installation and electrical plant. Issues relevant to Health and Safety are identified in the Outcomes of individual units. For example, the Electrical Plant Maintenance SCQF level 6 Unit requires candidates to carry out a risk assessment on electrical plant in preparation for a given maintenance task and apply safe isolation procedures on given plant. The Electrical Testing and Measurement SCQF level 6 Unit requires that candidates must carry out all electrical measurements in a safe and correct manner. As in the SCQF level 5 award this award also contains a large number of practical electrical installation units in the Optional Section in which Health and Safety is embedded in individual Outcomes of the units as appropriate.

Award Title	SCQF level	Health and Safety Content in the Award
Electronic Engineering	6	As with the SCQF level 5 Electronics award this award contains units in analogue and digital electronics and electrical principles. Health and Safety issues are recognised in relevant Outcomes of units. For example, safety features in all four Outcomes of the Unit Electronic Test Equipment and Measurement at SCQF level 6. In the Applications of Programmable Logic Controllers SCQF level 6 Unit candidates must describe safety considerations when dealing with the control of industrial processes using PLC.
Fabrication and Welding Engineering	6	This award contains largely theory based units. Such units contain reference to Health and Safety where appropriate (eg Thermal Cutting Processes at SCQF level 6 — candidates should be made aware about the health and safety implications of using explosive and toxic gases, electrical power, fire and fume). The Health and Safety: Engineering SCQF level 5 Unit is included in the Optional Section of the award to allow centres to provide candidates with underpinning knowledge and understanding of Health and Safety issues.
Manufacturing Engineering	6	This award has a mixture of theoretical and practical content. Theory based units highlight issues relevant to Health and Safety where appropriate (eg The implications of robot work envelope volume for reach and safety of a robot – Robotic and Automated Systems at SCQF level 6, factors involved in mechanical or product design to include safety and factor of safety – Engineering Design at SCQF level 6 etc.). The following practical units contain a dedicated Health and Safety Outcome: Engineering Assembly Skills at SCQF level 6 Engineering Workshop Skills at SCQF level 6 Materials Removal Practice: Milling at SCQF level 6 Materials Removal Practice: Turning at SCQF level 6 The Unit Industrial CNC Machining at SCQF level 6 has Health and Safety embedded in Outcome 3 where candidates are required to set tool offsets and run programmes on an industrial CNC machine to produce given components in a correct and safe manner.

Award Title	SCQF level	Health and Safety Content in the Award
Measurement and Control Engineering	6	This award contains an appropriate balance of theoretical and practical content in Measurement and Control. The Unit Engineering Hazards, Protection Methods and Functional Safety at SCQF level 6 provides candidates with opportunities to develop knowledge and understanding of hazards, protection methods and functional safety in process industries. Other units include advice on Health and Safety where appropriate (eg the Unit Engineering Measurement Technology: Temperature at SCQF level 6 includes the following advice, 'Candidates should be aware of the health and safety issues when using the calibration equipment.'
Mechanical Engineering	6	This award contains principally theory based Units with the Mandatory Core focussing on Mechanical Engineering Principles. Theory based units highlight issues relevant to Health and Safety where appropriate (eg factors involved in mechanical or product design to include safety and factor of safety – Engineering Design at SCQF level 6 etc.). For candidates wishing to pursue mechanical plant maintenance in the Optional Section of the award there is a Unit on Maintenance Safety at SCQF level 6, reflecting the crucial importance of Health and Safety in modern mechanical plant maintenance. Health and Safety is embedded into the relevant Outcomes of the following units which have practical content: Engineering Systems at SCQF level 6 Plant Installation at SCQF level 6 Plant Maintenance Practice at SCQF level 6 Pneumatics and Hydraulics at SCQF level 6 Electrical Plant Maintenance at SCQF level 6

6.2 Delivery and Assessment

Delivery

The new National Certificates in Engineering can be delivered by a range of different delivery modes. For example, they may be delivered on a day-release, block-release or evening class basis to candidates in employment. Alternatively, they may be delivered on a full-time basis to school leavers, adult returners etc. Examples of possible part-time and full-time timetables for some of the National Certificates in Engineering awards are shown in Appendix 3

Lecturers may use a variety of teaching and learning approaches in delivering the units in the National Certificate in Engineering awards. These may include lecturing, group work, laboratory exercises, practical work, computer simulation (using appropriate software packages), investigative work (including the use of the Internet), project work and case studies. The use of open and distance learning and on-line materials may help to supplement and support the learning that takes place in the classroom, laboratory or workshop.

Industrial visits are strongly recommended wherever possible to allow candidates to see examples of engineering systems in operation and to observe the application of engineering principles and practices in 'real engineering environments.'

Centres, working on their own or in partnership, might also wish to consider the following approaches to delivering the National Certificate in Engineering awards:

- Development of paper based and/or electronic assessment and teaching and learning materials for individual NQ units
- Identification and sharing of good candidate learning support materials already available on the Internet
- Identification of various sources of information, including those found on the Internet, to allow candidates to undertake more in-depth investigations in given subject areas
- Use of e-mentoring arrangements to support candidates who study at a distance

Centres should take account of information contained in the 'recommended entry' statement in NQ Unit specifications in sequencing the delivery of units. For example, it is recommended that candidates with no knowledge of electrical motors study the Unit *Rotating Electrical Machines* at SCQF level 5 before studying either the units *Single and Three Phase Induction Motors* at SCQF level 6 or *Direct Current Machines* at SCQF level 6.

Time spent on summative Unit assessment has been reduced in order to provide lecturers with more time to deliver units. Lecturers are encouraged, in particular, to use this additional time to reinforce learning in core engineering concepts, principles and practices.

Lecturers should also seek opportunities to integrate Core Skills within their teaching and learning programmes. Such opportunities may include, but not be limited to, the following:

Communication	♦ Provide candidates with opportunities to develop their oral skills by allowing them to give full answers to questions asked by the lecturer and by giving an oral presentation as part of Unit delivery ♦ Encourage candidates to read extensively on various technical subjects. Discuss reading with candidates to check understanding of subject matter ♦ Develop report writing skills in a number of units ♦ Allow candidates to develop their communication skills in group work activities
Numeracy	♦ Reinforce numeracy and mathematical skills when teaching engineering units ♦ Reinforce using graphical information skills by using and comparing a range of engineering graphical representations (eg in such units as Graphical Engineering Communication, Pneumatics and Hydraulics, Combinational Logic, Sequential Logic and Applications of Programmable Logic Controllers)
Information and Communication Technology	♦ Develop information technology skills through the application of I.T. within engineering (eg in the Units Engineering: Using Information Technology, or Engineering: Applying Information Technology, Computer Aided Draughting, Industrial CNC Machining etc.)
Problem Solving Skills	♦ Develop problem solving skills by, for example, exploring different solutions to problems; planning and organising appropriately prior to undertaking practical and project work; reviewing and evaluating different solutions to engineering problems and evaluating the quality of own work
Working with Others	♦ Develop working with others skills through such activities as group discussion about an engineering problem/issue, sharing resources in engineering workshop areas etc.

Assessment

From the outset of the National Certificates in Engineering development an appropriate assessment strategy has been put in place for these awards. This strategy is as follows:

Aims

The aims of the strategy are to ensure that:

1 consistent, rigorous and efficient approaches are adopted to the development and administration of NQ Engineering assessment instruments, which satisfy nationally agreed standards;

2 the assessment load on candidates and staff is sensible and that assessment does not unduly detract from teaching and learning;

3 as far as possible reliable and rigorous moderation processes are put in place in order to ensure that consistent national standards are achieved for all NQ Engineering Unit assessments.

Objectives

Listed below are the measures that have been put in place to meet the aims:

1 Develop nationally at least one Assessment Support Pack for the mandatory units and all units in the Restricted Core of all National Certificate in Engineering awards.

2 Adopt, where possible, a holistic approach to Unit assessment. The implications of this are that a Unit assessment strategy has been adopted, where appropriate, in which a single assessment instrument for a whole Unit can be used. Where this was not possible the assessment strategy sought to ensure that the minimum numbers of assessment instruments were required consistent with maintaining agreed national standards.

3 Whilst not seeking to be entirely prescriptive with regard to the time spent on assessment in NQ units, it is believed that over assessment should be avoided if assessment in individual NQ units is no greater than 2 hours.

4 Actively encourage centres to work in partnership in producing NQ Unit assessment materials, which meet nationally agreed standards, reducing the workload on staff in individual colleges.

5 Ensure that consistent and rigorous internal and external moderation procedures operate for NQ Unit assessment processes. This places a clear responsibility on both centres and the SQA.

As far as has been practical the above objectives have been adhered to when developing assessment support packs.

Assessment support packs

Assessment support packs have been produced for the three mandatory SCQF level 5 units and the three mandatory SCQF level 6 units. Assessment support packs have also been produced for all units in the restricted core sections of all National Certificate in Engineering awards. Once completed assessment support packs can be found on the secure part of the SQA website. Details of the assessment support packs which will be available for use can be found in Appendix 4.

Formative Assessment

Formative assessment should be used throughout the delivery of NQ units to reinforce learning, build candidates' confidence and prepare candidates for summative assessment.

6.3 Online, open and distance learning

SQA working in partnership with Coleg where appropriate have produced a range of on-line assessment and teaching and learning materials for the new National Certificate in Engineering awards. Details of e-assessment and teaching and learning materials which will be available can be found in Appendix 4. It is anticipated that additional materials may become available over the next few years.

Advice on the use of on-line and open and distance learning materials is given in individual NQ Unit specifications where it is considered that these modes of delivery are appropriate. However, where such modes of delivery are used due regard must be paid to assessment. Planning would be required by centres to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that the assessment or assessments were conducted under the conditions specified in the Unit specification. For example, in the case of a Unit which involved a test (s) a centre would have to make arrangements for the test (s) to be conducted under controlled, supervised conditions. Likewise, where a Unit involves a practical based assessment, a centre would have to make arrangements for candidates to come into the centre (or other appropriate venue) to undertake the assessment under the conditions specified in the NQ Unit specification.

6.4 Credit Transfer Arrangements

As noted in Section 2.1, many of the former NC Engineering modules in the SQA catalogue are dated. Given the changes in technology and working practices over the period since these modules were written it is unlikely that many credit transfer opportunities will exist between these NC modules and the new NQ units. Undertaking an exercise to investigate credit transfer opportunities between NC Engineering modules and the new NQ Engineering units would be a major project involving the commitment of a considerable resource. Such a resource commitment may be difficult to justify in terms of the number of centres seeking information on credit transfer. Thus, it is considered more appropriate to consider each centre's request for credit transfer information on an individual basis as they arise and build up a record of credit transfer decisions as these are made.

7 General information for centres

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

Internal and external verification

All instruments of assessment used within this/these Group Award(s) should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment and Quality Assurance for Colleges of Further Education* **(www.sqa.org.uk)**.

8 General information for candidates

Introduction

SQA has developed the following new National Certificates in Engineering:

National Certificate in Electrical Engineering at SCQF level 5
National Certificate in Electronic Engineering at SCQF level 5
National Certificate in Fabrication and Welding Engineering at SCQF level 5
National Certificate in Mechanical Maintenance Engineering at SCQF level 5
National Certificate in Manufacturing Engineering at SQCF level 5

National Certificate in Aeronautical Engineering at SCQF level 6
National Certificate in Electrical Engineering at SCQF level 6
National Certificate in Electronic Engineering at SCQF level 6
National Certificate in Fabrication and Welding Engineering at SCQF level 6
National Certificate in Manufacturing Engineering at SCQF level 6
National Certificate in Measurement and Control Engineering at SCQF level 6
National Certificate in Mechanical Engineering at SCQF level 6

The National Certificate awards at SCQF level 5 have been designed to allow candidates to develop the knowledge, understanding and skills to work now, or in the future, as skilled crafts persons or operatives in Electrical, Electronics, Fabrication and Welding, Maintenance or Manufacturing Engineering. National Certificates in Engineering at SCQF level 6 have been developed to provide the education and training for those seeking employment now, or at some future date, as engineering technicians in Aeronautical, Electrical, Electronics, Fabrication and Welding, Manufacturing, Measurement and Control or Mechanical Engineering.

Award content

Each National Certificate in Engineering comprises the following three sections: mandatory, restricted core and optional. The mandatory section contains units in communication, numeracy/mathematics and information and communication technology. Irrespective of which field of engineering you wish to go into it is important that you can read and understand technical information, speak to others effectively while working and present technical information in written form in a correct and concise manner and free from spelling and grammatical mistakes. All fields of engineering involve some calculations and the use of mathematics and it is important that you are competent in numeracy and mathematics if you are going to work as a craftsperson or technician. Information technology is also important whether you are using word processing and graphics packages to produce a report or a computer simulation package to model an engineering process or system.

The restricted core section of each National Certificate contains units that relate directly to the title of the award. This section really defines what the award is about. For example, if you are studying a National Certificate in Fabrication and Welding Engineering you will find that the units in the restricted core section relate directly to Fabrication and Welding.

The optional section of each National Certificate in Engineering allows you the flexibility to choose four units from a range of units. The choice of units you make may depend on the following factors:

- wanting to study the engineering subject described by the title of the award in more depth
- wanting to study other areas of engineering
- wanting to do additional mathematics because you want to progress to a more advanced course
- needing to study certain units to satisfy your employer's needs
- having a career or personal interest in a certain subject, or subjects

Teaching

While studying a National Certificate in Engineering award, the teaching and learning approaches adopted by your lecturers may include the following: lecturing, group work, practical engineering work, measurement and testing, computer simulation, investigations (including the use of the Internet) and project work. Industrial visits may also be included in your course to allow you to see 'real life' engineering systems in action.

Assessment

SQA has designed each National Certificate award to ensure that assessments meet national standards. Every attempt has been made to optimise assessment so that sufficient time is available for you to learn both the practical and theory to become a good craftsperson or technician.

Individual NQ Unit assessments will normally consist of practical exercises, written tests, assignments, laboratory work, computer simulations or project work. Your lecturer should tell you at the start of the Unit what form the Unit assessment will take.

Progression

On successfully completing a National Certificate in Engineering at SCQF level 5 you can progress to an Advanced Certificate in the same engineering discipline area and then to an HNC in Engineering Practice. For example, if you successfully achieve a National Certificate in Engineering Maintenance at SCQF level 5 you will be able to progress to an Advanced Certificate in Engineering Maintenance and then a HNC Engineering Practice. If you successfully complete a National Certificate in Engineering at SCQF level 6 you will be able to progress to an HNC/HND in the same engineering discipline area. For example, if you successfully achieve a National Certificate in Measurement and Control Engineering at SCQF level 6 you will be able to proceed to an HNC/HND in Measurement and Control Engineering.

9 Glossary of terms

SCQF: This stands for the Scottish Credit and Qualification Framework, which is a new way of speaking about qualifications and how they inter-relate. We use SCQF terminology throughout this guide to refer to credits and levels. For further information on the SCQF visit the SCQF website at **www.scqf.org.uk**

SCQF credit points: One SCQF credit point equates to 10 hours of learning. NQ Units at SCQF levels 2–6 are worth 6 SCQF credit points, NQ Units at level 7 are worth 8 SCQF points.

SCQF levels: The SCQF covers 12 levels of learning. National Qualification Group Awards are available at SCQF levels 2–6 and will normally be made up of National Units which are available from SCQF levels 2–7.

Dedicated Unit to cover Core Skills: This is a non-subject Unit that is written to cover one or more particular Core Skills.

Embedded Core Skills: This is where the development of a Core Skill is incorporated into the Unit and where the Unit assessment also covers the requirements of Core Skill assessment at a particular level.

Signposted Core Skills: This refers to the opportunities to develop a particular Core Skill at a specified level that lie outwith automatic certification.

Qualification Design Team: The QDT works in conjunction with a Qualification Manager/Development Manager to steer the development of the National Certificate/National Progression Award from its inception/revision through to validation. The group is made up of key stakeholders representing the interests of centres, employers, universities and other relevant organisations.

Consortium-devised National Certificates/National Progression Awards are those developments or revisions undertaken by a group of centres in partnership with SQA.

10 Appendices

Appendix 1: Core Skills Development Opportunities within the new NC in Engineering awards
Appendix 2: Alignment of NQ Engineering Units with National Occupational Standards
Appendix 3: Sample Timetables for NC in Engineering awards
Appendix 4: Assessment and Teaching and Learning Materials available to support the NC in Engineering awards

Appendix 1: Core Skills Development Opportunities within the new NC in Engineering awards

National Certificate in Electrical Engineering (SCQF level 5)

Opportunities for Core Skills development

The award includes mandatory Units in *Mathematics, Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

Numeracy is a fundamental tool in the discipline of Electrical Engineering which requires the ability to translate, apply and produce data in graphic and numerical forms. Candidates learn skills in the practical interpretation, calculation and presentation of data in work based contexts.

All the elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates learn to identify, consider and take into account all factors impacting on Electrical Engineering work. Technical information is interpreted, and decisions are made on approaches, techniques and resources which comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches if necessary. Inspection and testing provide opportunities for the review and evaluation of achievement, with assessor guidance and feedback.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in practical work related contexts. The ability to interpret, apply and communicate technical information in written, oral and graphic form is important, and examples from industry will be used to indicate acceptable formats, structures and terminology.

Practical work and organised site visits will provide opportunities for developing work related communication skills and promoting good team relationships with others.

Information Technology is an essential tool for reference and investigations to ensure currency of underpinning knowledge. Skills may be further strengthened by access to on line tutorials and e learning, including use of a range of software packages. Responsible and secure use of equipment and consideration for the needs of other users will be routine practice.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Numeracy (SCQF level 5)

Using Number

- apply a wide range of numerical skills

Using Graphical Information

- interpret and communicate graphical information in everyday and generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Craft 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Electrical Testing and Measurement	A series of calculations and measurements is performed before applying and recording information to demonstrate effective working practice.	✓	✓
Electrical Principles	Interpretation of electrical field theory and fundamental magnetic and electromagnetic principles. Sketches of magnetic fields; determining force, quantities and properties.	✓	✓
Electrical Wiring Skills	Identification of information and calculation using numerical and graphic data, applied in the creation of product evidence.	✓	✓
Installation of Conduit Systems	A series of measurements to given dimensions; interpretation and production of wiring diagrams. Information is applied practically.	✓	✓
The ability to interpret, apply and convey information in graphical and numerical form is integral to achievement across the award. Data has to be calculated, translated as needed into diagrams or sketches, with information applied to installation solutions. Accuracy is essential at all stages.			

Problem Solving (SCQF level 5)

Critical Thinking

- analyse a situation or issue

Planning and Organising

- plan, organise and complete a task

Reviewing and Evaluating

- review and evaluate a problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Earthing Systems	Identification of merits and weaknesses of a range of earthing systems, decision making on an appropriate approach, Wiring and testing an arrangement to comply with current regulations.	✓	✓	✓
Safe Working Practices	Identification and analysis of all relevant factors, including current legislation, in the promoting and implementing of safe working practices.	✓	✓	✓
Electrical Wiring Skills	Selection of techniques, tools and accessories to mount electrical accessories and wire simple electrical installations. Checking adherence to regulations and requirements.	✓	✓	✓
Electrical Testing and Measurement	Analysing potential sources of error, selection of appropriate equipment to test efficiently and safely and inspect and check results.	✓	✓	✓
Installation of Conduit Systems	Interpretation of installation specification, selection of appropriate tools, safe assembly of fabricated sections to form a conduit system.	✓	✓	✓
Candidates identify essential needs and plan solutions for a range of practical electrical engineering situations across the award. They apply knowledge and skills to specifications, taking account of legislation and health and safety requirements as they complete work. Inspection, testing and evaluation of achievement are supported by assessor feedback.				

Communication (SCQF level 5)

(Reading, Writing and Oral)

- Read, understand and evaluate written communication
- Produce well-structured written communication
- Produce and respond to oral communication

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Summary and evaluation of vocational document. Structured and technically accurate portfolio – minimum 500 words. Group discussion, decision making and record keeping.	✓	✓	✓
Earthing Systems	Understanding and applying current BS7671 Wiring Regulations; formative discussion on safety issues and equipment.	✓		✓
Safe Working Practices	Detailed awareness and application of relevant Standards and Legislation essential to industry practice. Written responses using correct technical terminology.	✓	✓	✓
Fundamental Electrical Systems	Understanding and evaluation of appropriate reference materials. Production and presentation of written and/or oral work to a standard acceptable in industry.	✓	✓	✓
Rotating Electrical Machines	Evaluation of underpinning technical data. Written structured responses using correct technical terminology. Discussions on basic systems and the need for isolation, control and protection of Low Voltage installations.	✓	✓	✓
Application of information on statutory and regulatory responsibilities and controls is essential to achievement. Skills developed across the award include the ability to produce accurate, clear written information, supported by graphics, in workbooks, reports and written responses. Candidates have opportunities to provide some evidence orally. Practical activities and visits provide further opportunities to develop oral skills and use technical terminology in context.				

Working with Others (SCQF level 5)

Work with Others to complete a task

- analyse the activity and identify component tasks and roles
- agree allocation of activities taking account of group strengths and weaknesses
- support co-operative working
- evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group discussion, decision making and agreement.	✓	✓	✓	✓
Safe Working Practices	Underpinning theory outlining needs, strategies and benefits of co-operative working with a range of others.	✓	✓	✓	✓
Electrical Testing and Measurement	Formative work in workplace conditions – team roles and responsibilities in promoting and implementing safe working practices.	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	Practical work provides an environment in which to discuss and practise team working, and to review and evaluate the process with assessor guidance.	✓	✓	✓	✓
All practical learning and assessment tasks will develop team working skills and support the ability to form working relationships in practical vocational contexts. Feedback from assessors on good practice will be on-going. Organised site visits will involve contributing and co-operating in group activities and observation of industry practice.					

Using Information Technology (SCQF level 5)

Use an IT system effectively and responsibly to process a range of information

- make effective and responsible use of the range of IT equipment in everyday use
- apply a range of skills from more than one area of software application
- integrate different types of data
- carry out two searches to extract and present relevant information from electronic data sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Using Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Safe Working Practices	Accessing current background information from various sources including electronic to assure understanding of safety regulations and procedures.	✓	✓		✓
Rotating Electrical Machines	Internet research on the construction, principles of operation and applications of various types of motors and generators.	✓	✓	✓	✓
Security, Alarm and Communication Systems	Understanding of the operation of a basic hard-wired LAN data communication system.	✓	✓		✓
Internet access for investigation of essential underpinning knowledge and current reference sources of technical information. On line contact e-learning and support will be available as appropriate.					

National Certificate in Electronic Engineering (SCQF level 5)

Opportunities for Core Skills development

The award includes mandatory Units in **Mathematics, Information Technology** and **Communication** which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning, and Organising, Reviewing and Evaluating underpin the general competencies developed in the award. As each practical activity is undertaken candidates have to identify and analyse a range of factors affecting Electronic Engineering practice. Decisions are made on techniques and methods to comply with regulatory and safety requirements. Implementation includes the ability to adapt and modify approaches and record results and processes in workbooks. Inspection and testing provides opportunities for assessor feedback and the reflective evaluation of achievement.

Numeracy is fundamental to the discipline of Electronic Engineering with the need to analyse, apply and produce information using both number and graphics. Candidates have to be able to work confidently with a number of numerical and graphic concepts and as they apply understanding to solve problems they interpret and represent information in appropriate formats. The focus of formative activities is on Numeracy as a tool to be used efficiently in practical Electronic engineering contexts.

Access to *Information Technology* ensures currency of underpinning knowledge. Skills are strengthened by the availability of a range of on line tutorial resources and support. Responsible and secure use of equipment and consideration of the needs of other users will be routine practice.

Ways of enhancing abilities in *Communication* and *Working with Others* are explored in practical work related contexts. The ability to interpret, apply and communicate technical information in written, oral and graphic form is important and examples from industry will be used to indicate acceptable formats, structures and terminology. Task based work will provide opportunities to enhance oral communication skills and promote awareness of roles and responsibilities in workplace team relationships.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 5)

Critical Thinking

- analyse a situation or issue

Planning and Organising

- plan, organise and complete a task

Reviewing and Evaluating

- review and evaluate a problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Combinational Logic	Planning and completion of preliminary investigations, construction of circuits and testing of operation.	✓	✓	✓
Electronic Test Equipment and Measurement	Consideration of regulations and safety factors. Setting up of electronic test equipment to measure and test accurately to given specification.	✓	✓	✓
Fundamental Electronics	Identification and connection of power source before selecting and connecting appropriate test equipment. Construction, measurement and testing of the circuit.	✓	✓	✓
Practical Electronics	Selection of methods and techniques; safe use of electronic construction tools to construct working analogue and digital electronic circuits.	✓	✓	✓
Soldering and Circuit Assembly Techniques	Consideration of methods for preventing damage to components materials and identification of safe working practices. Selection of methods, materials before working digital electronic circuit is assembled correctly and checked.	✓	✓	✓
Candidates identify essential needs and apply solutions to a range of practical electronic engineering issues across the award. They apply knowledge and skills to take into account relevant legislation, and health and safety requirements. Testing and evaluation of achievement and solutions is routine practice, supported by assessor demonstration and feedback.				

Numeracy (SCQF level 5)

Using Number

- apply a wide range of numerical skills

Using Graphical Information

- interpret and communicate graphical information in everyday and generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Craft 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Circuit Element Devices	Parameters for given specifications are determined and total resultant capacitance or inductance calculated and recorded.	✓	✓
Combinational Logic	Interpretation, conversion, application and production of data in diagrams.	✓	✓
Semiconductor Applications	Investigation of use of diodes and transistors within electronic circuit applications — determining, measuring and recording effects.	✓	✓
Transformation and Rectification	Investigations involving interpreting and sketching input and output waveforms and comparing measured values. Checking and recording the operation of full-wave bi-phase rectifier circuits.	✓	✓
The ability to interpret, apply and communicate numerical and graphical information is integral to achievement. Accurate use of number, symbols, sketches and diagrams is taught and candidates have the option of development to SCQF level 6. Data is measured, determined, calculated, presented and applied.			

Using Information Technology (SCQF level 5)

Use an IT system effectively and responsibly to process a range of information

- make effective and responsible use of the range of IT equipment in everyday use
- apply a range of skills from more than one area of software application
- integrate different types of data
- carry out two searches to extract and present relevant information from electronic data sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Using Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Electronic Simulation and Testing	Accessing current background information from various sources including electronic to assure understanding of safety promotion and procedures.	✓	✓	✓	✓
Communication	Internet research on technical information and industry case studies as part of Investigative assignment. Presentation to professional standard.	✓	✓	✓	✓
Investigative research on current technical information will be enhanced by access to the Internet to provide essential underpinning knowledge for the award. Professional software packages will be provided as appropriate. On line guidance and tutorial support will be available as needed. Security, consideration for other users will be a routine aspect of good practice.					

Communication (SCQF level 5)

(Reading, Writing and Oral Communication)

- Read, understand and evaluate written communication
- Produce well-structured written communication
- Produce and respond to oral communication

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Summary and evaluation of vocational document. Structured and technically accurate portfolio — minimum 500 words. Group discussion, decision making and record keeping.	✓	✓	✓
Power Electronics	Practical activities provide opportunities to develop written and oral skills using correct technical terminology.	✓	✓	✓
Power Supplies	Reading, demonstrating and discussing the operation of regulated power supplies. Detailing in evidence.	✓	✓	✓
Sequential Logic	Investigation of characteristics and operations associated with devices, circuits and techniques of Sequential logic is applied to assembly and construction.	✓	✓	✓
Soldering and Circuit Assembly Techniques	Understanding and application of statutory Standards and Legislation. Discussion of industry practice. Records of construction details, test methods and results accurately detailed in workbooks.	✓	✓	✓
Candidates read and apply information from web sites and paper based resources such as technical reports, data sheets and manufacturers' guides. Understanding of statutory and regulatory responsibilities and controls is critical. Skills developed in the award include the ability to produce factually and technically accurate written information in workbooks, reports and written responses to the standards required within the vocational area. Candidates have opportunities to provide some evidence orally. Practical activities provide opportunities to develop oral skills using correct technical terminology in workplace situations.				

Working with Others (SCQF level 5)

Work with Others to complete a task

- analyse the activity and identify component tasks and roles
- agree allocation of activities taking account of group strengths and weaknesses
- support co-operative working
- evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: team work and decision making in group discussion on technical issues. Formal records written up.	✓	✓	✓	✓
Electronic Simulation and Testing	During formative activities candidates plan and undertake investigations, construct circuits and test the operation applying team roles and responsibilities with assessor guidance.	✓	✓	✓	✓
Electronic Test Equipment and Measurement	Practical laboratory work provides an environment in which to learn, use test equipment and work in groups.	✓	✓	✓	✓
Soldering and Circuit Assembly Techniques	Formative practical activities in a working environment mean agreement on group contributions to safety, monitoring and evaluation of progress.	✓	✓	✓	✓
All practical tasks will develop team working skills and support the ability to form working relationships with a range of others in practical vocational contexts. Demonstrations will involve observation of industry practice and co-operation in group activities with assessor feedback on achievement.					

National Certificate in Fabrication and Welding Engineering

(SCQF level 5)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates learn to identify, consider and take into account a range of factors impacting on Fabrication and Welding Engineering. Instructions are interpreted, and decisions are made on techniques, tools and resources to comply with regulatory and safety requirements. Implementing requirements effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing, with assessor guidance and feedback, provide opportunities for the review and evaluation of achievement. *Numeracy* is an essential tool in Fabrication and Welding which requires the ability to translate, produce and apply data provided in graphic and numerical forms. Skills are learnt in the accurate, practical interpretation of information as candidates interpret instructions, identify dimensions from drawings and perform and report on dimensional and quality checks.

Ways of enhancing skills in *Communication* and *Working with Others* are also explored in practical situations. Practical activities will provide opportunities for developing work related communication skills and promoting good team relationships with others. The ability to interpret, apply and communicate technical information in written, oral and graphic form is important and examples from industry will be used to indicate acceptable formats, structures and terminology.

Information Technology is an essential reference tool to ensure currency of underpinning knowledge. Skills may be further strengthened by access to on line tutorials and a range of professional software packages. Responsible and secure use of equipment and consideration for the needs of other users will be routine practice.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 5)

Critical Thinking

- analyse a situation or issue

Planning and Organising

- plan organise and complete a task

Reviewing and Evaluating

- review and evaluate a problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Welding Processes	Equipment and consumables are selected, and quality factors identified. Formative experience of each of the welding processes in a workshop environment reinforces theory and teaches problem solving approaches.	✓	✓	✓
Thermal Cutting Skills	Theory is applied to a practical task making decisions on methods and approaches appropriate to materials and aims. Results are inspected and checked.	✓	✓	✓
Fabrication Skills	Interpretation of specification, selection of appropriate tools, safe manufacture, and dimension and quality checking.	✓	✓	✓
Health and Safety: Engineering	Application of current Health and Safety legislation to assure workplace safety; completion of risk assessment within a given engineering environment.	✓	✓	✓
Engineering Project	Identification and analysis of all relevant factors, including current legislation, use of appropriate equipment and safe working practices in practical work.	✓	✓	✓
Candidates have to identify essential issues and select suitable techniques and equipment to complete practical tasks to given specifications. They apply knowledge and skills to complete work efficiently. Legislative controls, Health and Safety implications and the impact on the environment will be taken into account. Inspection and quality checks to evaluate achievement is supported by assessor feedback. Group discussion to support on going reflective evaluation of efficiency and achievement is routine.				

Numeracy (SCQF level 5)

Using Number

- apply a wide range of numerical skills

Using Graphical Information

- interpret and communicate graphical information in everyday and generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Craft 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Fabrication Skills	Practical calculations using graphical and numerical data to mark out, cut, and inspect completed assemblies, ensuring accuracy, quality and safety.	✓	✓
Thermal Cutting Skills	Calculations and measurements are performed in setting up and using equipment to ensure accuracy and safety in cutting.	✓	✓
Engineering Project	Analysis of information, calculation using numerical and graphic data applied in the creation of product evidence. Measurements to given dimensions are completed and quality checked.	✓	✓
The ability to interpret, apply and convey information in graphical and numerical form is integral to achievement across the award. Data has to be calculated and translated as needed into diagrams or sketches, with information applied to practical solutions. Accuracy is essential at all stages.			

Communication (SCQF level 5)

(Reading, Writing and Oral)

- Read, understand and evaluate written communication
- Produce well-structured written communication
- Produce and respond to oral communication

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Summary and evaluation of vocational document. Structured and technically accurate portfolio – minimum 500 words. Group discussion, decision making and record keeping.	✓	✓	✓
Health and Safety: Engineering	Understanding and application of relevant Standards and Legislation essential to industry practice. Risk assessment report.	✓	✓	
Engineering Project	Consulting and evaluating appropriate reference materials. Production and presentation of written and/or oral work to a standard acceptable in industry.	✓	✓	✓
Welding Processes	Evaluation and summary of technical information. Written structured responses using correct technical terminology. Formative workshop discussion of issues.	✓	✓	✓
Understanding, evaluating and applying information on statutory and regulatory responsibilities and controls is integral to achievement. Skills developed across the award include the ability to produce accurate, clear written information in workbooks, reports and written evidence responses. Candidates have opportunities to provide some evidence orally. Practical activities provide opportunities to develop oral skills and use technical terminology in context.				

Working with Others (SCQF level 5)

Work with Others to complete a task

- analyse the activity and identify component tasks and roles
- agree allocation of activities taking account of group strengths and weaknesses
- support co-operative working
- evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group discussion, decision making and agreement.	✓	✓	✓	✓
Health and Safety: Engineering	Underpinning theory outlining needs, strategies and benefits of co-operative working with a range of others.	✓	✓	✓	✓
Fabrication Processes	Formative work in workplace conditions – theory of team responsibilities in promoting and implementing safe working practices.	✓	✓	✓	✓
MIG/MAG Welding Skills	Practical work provides an environment in which to discuss and practice team working, and to review and evaluate the process with assessor guidance.	✓	✓	✓	✓
All practical learning and assessment tasks will develop team working skills and support the ability to form working relationships in practical vocational contexts. Feedback from assessors on good practice will be on-going. Organised site visits will involve contributing and co operating in class group activities and observation of industry practice.					

Using Information Technology (SCQF level 5)

Use an IT system effectively and responsibly to process a range of information

- make effective and responsible use of the range of IT equipment in everyday use
- apply a range of skills from more than one area of software application
- integrate different types of data
- carry out two searches to extract and present relevant information from electronic data sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Using Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Computer Aided Draughting	Use of professional software packages to outline and present design solutions.	✓	✓	✓	✓
Health and Safety: Engineering	Accessing information from various sources including electronic to assure understanding of current safety regulations and procedures.	✓	✓	✓	✓
Communication	Internet research for and presentation of Outcome 2 report.	✓	✓	✓	✓
Internet access will be available to provide essential underpinning knowledge and current reference sources of technical information. Presentation and record keeping of researched information may involve technology. On line contact and support and e-learning opportunities will be available as appropriate.					

National Certificate in Mechanical Maintenance Engineering (SCQF level 5)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates learn to identify, consider and take into account a range of factors impacting on practical engineering work. Specifications are interpreted, and decisions are made on techniques, tools and materials which comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for the review and evaluation of achievement, with assessor guidance and feedback.

Numeracy is an essential tool in Maintenance Engineering as candidates read, translate, apply and present data in graphic and numerical forms. Skills are learnt in the accurate, practical interpretation of information in work based contexts.

Ways of enhancing skills in *Communication* and *Working with Others* are also explored in practical situations. Practical work will provide opportunities for developing work related communication skills and promoting good team relationships with others. The ability to interpret, apply and communicate technical information in written, oral and non-verbal form is important and acceptable formats, structures and terminology for the vocational area will be demonstrated.

Information Technology is an essential reference tool to ensure currency of underpinning knowledge. Skills may be further strengthened by on line tutorials and use of a range of simulation software packages. Responsible and secure use of equipment and consideration for the needs of other users will be routine practice.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 5)

Critical Thinking

- analyse a situation or issue

Planning and Organising

- plan, organise and complete a task

Reviewing and Evaluating

- review and evaluate a problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Mechanical Engineering Principles	Mechanical engineering principles have to be applied to determine needs in systems and work out solutions which assure energy, conservation of energy and power.	✓	✓	✓
Plant Maintenance Practice	Consideration of workshop regulations and safety factors. Selection and use of equipment in routine maintenance and fault diagnosis. Discussion with assessor of best practice.	✓	✓	✓
Plant Installation	Analysis of relevant legislation and manufacturers' specifications, before installing, commissioning and testing mechanical plant.	✓	✓	✓
Pneumatics and Hydraulics	Safe assembly, testing and fault finding in pneumatic or hydraulic circuits. Checking, rectifying and reporting faults.	✓	✓	✓
Candidates have to identify needs and select suitable approaches, equipment and techniques to complete practical tasks to given specifications. They have to apply their knowledge and skills to complete work efficiently. Regulations and Health and Safety requirements must be taken into account and at all times. Inspection and quality checks to evaluate efficiency are supported by assessor support and feedback. Group discussion and on-going reflective review of achievement is routine practice.				

Numeracy (SCQF level 5)

Using Number

- apply a wide range of numerical skills

Using Graphical Information

- interpret and communicate graphical information in everyday and generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Craft 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Mechanical Engineering Principles	Candidates interpret, calculate and translate numerical and graphical data manipulating and evaluating equations to solve problems involving mechanical engineering principles, machines and heat.	✓	✓
Plant Installation	Extraction and application of information from installation drawings. Leveling and aligning to given specifications.	✓	✓
Pneumatics and Hydraulics	Interpretation of graphic and written information underpins calculation and translation of technical data.	✓	✓
The ability to accurately interpret and apply written and graphic information relevant to standards and specifications is essential to achievement across the award. Technical data has to be calculated, translated as needed into diagrams or sketches, and information must be applied to practical solutions. Accuracy is essential at all stages.			

Communication (SCQF level 5)

(Reading, Writing and Oral)

- Read, understand and evaluate written communication
- Produce well-structured written communication
- Produce and respond to oral communication

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Summary and evaluation of vocational document. Structured and technically accurate portfolio — minimum 500 words. Group discussion, decision making and record keeping.	✓	✓	✓
Plant Maintenance Practice	Reading manufacturers' technical information and completing Permit to Work and other technical documentation.	✓	✓	✓
Maintenance Safety	Discussion and investigation of current standards and codes of practice in Maintenance engineering. Responses use industry language, structure and formats.	✓	✓	✓
Electrical Plant Safety and Maintenance	Evaluation, summary and application of technical information. Written structured responses using correct technical terminology. Formative workshop discussion of issues.	✓	✓	
Understanding and applying manufacturers' data and all information on statutory and regulatory responsibilities and controls is integral to achievement. Skills developed across the award include the ability to produce accurate, clear written information in workbooks, reports and written responses. Practical activities provide opportunities to develop oral and non verbal communication skills and use technical terminology in a workshop environment.				

Working with Others (SCQF level 5)

Work with Others to complete a task

- analyse the activity and identify component tasks and roles
- agree allocation of activities taking account of group strengths and weaknesses
- support co-operative working
- evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group discussion, decision making and agreement.	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	Theoretical underpinning knowledge which will be applied across practical award activities.	✓	✓		
Plant Maintenance Practice	Group co-operation in routine maintenance tasks to adhere to regulations and requirements and assure safety and good practice. Assessor feedback.	✓	✓	✓	✓
Plant Installation	Interpretation of installation specification, selection of appropriate tools and techniques — agreement of team responsibilities in promoting and implementing safe working practices.	✓	✓	✓	✓
All formative work will develop and promote group skills and support the ability to form co-operative working relationships in vocational contexts. Practical tasks could involve contributing to class group activities and observation of industry practice. Feedback from assessors on good team practice will be on-going and encourage review and evaluation of practice. An optional dedicated Core Skill Unit is included in the award.					

Using Information Technology (SCQF level 5)

Use an IT system effectively and responsibly to process a range of information

- make effective and responsible use of the range of IT equipment in everyday use
- apply a range of skills from more than one area of software application
- integrate different types of data
- carry out two searches to extract and present relevant information from electronic data sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
IT for Engineering 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Pneumatics and Hydraulics	Use of simulation software. Loading programs, identifying errors and running simulations.	✓	✓	✓	✓
Maintenance Safety	Accessing information from various sources including electronic to assure understanding of current safety regulations and procedures.	✓	✓	✓	✓
Communication	Internet research for Outcome 2 written report. Presentation of report.	✓	✓	✓	✓
Internet access will provide essential underpinning knowledge and current reference sources of technical information. Presentation of information and note keeping may involve technology. On line contact and support and e-learning opportunities may be available if appropriate.					

National Certificate in Manufacturing Engineering (SCQF level 5)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates learn to identify, consider and take into account a range of factors impacting on practical engineering work. Specifications are interpreted, and decisions are made on techniques, tools and materials which comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for the review and evaluation of achievement, with assessor guidance and feedback.

Numeracy is an essential tool in Manufacturing Engineering as candidates translate, produce and apply data in graphic and numerical forms. Skills are learnt in the accurate, practical interpretation of information in work based contexts.

Ways of enhancing skills in *Communication* and *Working with Others* are also explored in practical situations. Practical work will provide opportunities for developing work related communication skills and promoting good team relationships with others. The ability to interpret, apply and communicate technical information in written, oral and graphic form is important and examples from industry will be used to indicate acceptable formats, structures and terminology.

Information Technology is an essential reference tool to ensure currency of underpinning knowledge. Skills may be further strengthened by access to on line tutorials and a range of professional software packages. Responsible and secure use of equipment and consideration for the needs of other users will be routine practice.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 5)

Critical Thinking

- analyse a situation or issue

Planning and Organising

- plan organise and complete a task

Reviewing and Evaluating

- review and evaluate a problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Engineering Assembly Skills	Consideration of workshop regulations and safety factors. Selection and use of tools to produce engineering assemblies; testing accurately to a given specification.	✓	✓	✓
Engineering Dimensional Control	Use of linear and angular dimensional information from drawings to measure, record and check dimensions of engineering components.	✓	✓	✓
Industrial CNC Machining	Equipment and consumables are selected, and quality factors identified. Application in a workshop environment reinforces theory and teaches problem solving approaches.	✓	✓	✓
Materials Removal Practice: Milling/Turning	Identification, selection and application of techniques, methods and tooling safely in workshop conditions to manufacture components safely to given specifications. Results are inspected and checked.	✓	✓	✓
Engineering Workshop Skills	Identification and analysis of all relevant factors, including current legislation, use of appropriate equipment and safe working practices in practical work.	✓	✓	✓
Candidates have to identify essential issues and select suitable techniques and equipment to complete practical tasks to given specifications. They apply knowledge and skills to complete work efficiently. Legislative controls and Health and Safety implications are taken into account. Inspection and quality checks to evaluate achievement are supported by assessor feedback. Group discussion to support on going reflective evaluation of efficiency and achievement is routine practice.				

Numeracy (SCQF level 5)

Using Number

- apply a wide range of numerical skills

Using Graphical Information

- interpret and communicate graphical information in everyday and generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Craft 1	Using Number is fully developed in this Unit. Using Graphical Information is partially developed throughout the Unit.	✓	
Engineering Assembly Skills	Calculations and measurements are performed in setting up and using equipment to ensure accuracy and safety in cutting.	✓	✓
Engineering Dimensional Control	Extraction of linear and angular dimensional information from drawings to measure and record the dimensions of engineering components.	✓	✓
Engineering Workshop Skills	Analysis of information relevant to standards and specifications, calculation using numerical and graphic data applied in the creation of product evidence. Measurements to given dimensions are completed and quality checked.	✓	✓
Material Removal Practice: Milling	Interpretation of information from a component drawing. Use measuring equipment to work within accepted tolerances.		
The ability to accurately interpret and apply written and graphic information relevant to standards and specifications is essential to achievement across the award. Technical data has to be calculated, translated as needed into diagrams or sketches, and information must be applied to practical solutions. Accuracy is essential at all stages.			

Communication (SCQF level 5)

(Reading, Writing and Oral)

- Read, understand and evaluate written communication
- Produce well-structured written communication
- Produce and respond to oral communication

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Summary and evaluation of vocational document. Structured and technically accurate portfolio — minimum 500 words. Group discussion, decision making and record keeping.	✓	✓	✓
Engineering Manufacturing Processes	Investigation of current standards and codes of practice in engineering manufacture. Responses to professional structure and formats.	✓	✓	
Engineering Workshop Skills	Evaluation, summary and application of technical information. Written structured responses using correct technical terminology. Formative workshop discussion of issues.	✓	✓	✓
Understanding and applying information on statutory and regulatory responsibilities and controls is integral to achievement. Skills developed across the award include the ability to produce accurate, clear written information in workbooks, reports and written evidence responses. Candidates have opportunities to provide some evidence orally. Practical activities provide opportunities to develop oral skills and use technical terminology in a workshop context.				

Working with Others (SCQF level 5)

Work with Others to complete a task

- analyse the activity and identify component tasks and roles
- agree allocation of activities taking account of group strengths and weaknesses
- support co-operative working
- evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group discussion, decision making and agreement.	✓	✓	✓	✓
Engineering Assembly Skills	Group co-operation to assure safety and sound workshop practice to produce engineering assemblies to a given specification.	✓	✓	✓	✓
Engineering Manufacturing Processes	Underpinning theory outlining needs, strategies and benefits of co-operative working with a range of others.	✓	✓	✓	✓
Engineering Workshop Skills	Practical work in workplace conditions — team responsibilities in promoting and implementing safe working practices.	✓	✓	✓	✓
All practical learning and assessment tasks will develop team working skills and support the ability to form working relationships in practical vocational contexts. Feedback from assessors on good practice will be on-going. Organised site visits will involve contributing and co operating in class group activities and observation of industry practice. An optional dedicated Core Skill Unit is also included in the framework.					

Using Information Technology (SCQF level 5)

Use an IT system effectively and responsibly to process a range of information

- make effective and responsible use of the range of IT equipment in everyday use
- apply a range of skills from more than one area of software application
- integrate different types of data
- carry out two searches to extract and present relevant information from electronic data sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Using Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Industrial CNC Machining	Use of CNC Milling machines and CNC lathes to become familiar with industrial programming language and simulation software. Loading programs, identifying errors and running simulations.	✓	✓	✓	✓
Engineering Manufacturing Processes	Accessing information from various sources including electronic to assure understanding of current safety regulations and procedures.	✓	✓	✓	✓
Computer Aided Draughting	Use of professional software packages to produce and present design solutions.	✓	✓	✓	✓
Communication	Internet research for, and presentation of, Outcome 2 written report.	✓	✓	✓	✓
Internet access will provide essential underpinning knowledge and current reference sources of technical information. Presentation of information and note keeping may involve technology. On line contact and support and e-learning opportunities should be available as appropriate.					

National Certificate in Aeronautical Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, reviewing and evaluating underpin the competencies developed in the award. As the course is undertaken candidates learn to identify and justify suitable solutions which take into account such factors as airworthiness requirements, operating conditions and customer service. Needs are analysed and decisions made on efficient working practice to comply with regulatory requirements. Health and safety issues are identified analysed and requirements adhered to. Applying knowledge and understanding to a range of technical issues will develop the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities, using industry guidelines, for formal review and evaluation.

Numeracy is fundamental to the discipline of Aeronautical Engineering which requires the ability to understand and clarify the significance of information in graphic and numerical forms. Candidates learn the principles underpinning aircraft systems and structures and interpret, calculate and apply data in work based contexts. Communication of technical information is supported by clearly annotated sketches and diagrams.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation, evaluation and communication of complex technical information in written and oral format are essential. Examples from industry will be used to indicate acceptable formats, structure and terminology. Discussion during practical work and hangar visits will provide opportunities for work related oral communication and examples of co-operative working in team relationships. Candidates will be encouraged to explore the nature and scope of goals, roles and responsibilities, reviewing and evaluating their personal contribution to good working practice.

Information Technology is an essential reference tool. Undertaking on-line investigative research will ensure that underpinning knowledge is comprehensive and up to date; e-learning opportunities will become increasingly available. Computer simulation software will be used to confirm and reinforce theory taught in the award. Responsible and secure use of equipment and consideration of the needs of other users will be routine practice.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Aeronautical Engineering Fundamentals	Analysis of fuel efficiency, storage capacity, manoeuvrability, cost effectiveness and range in selection of aircraft.	✓		✓
Aircraft Flight Controls	Consideration of relationships and function of components of manual and automatic flight systems. Identification and analysis of relevant factors including essential requirements/ methods for setting flight controls and performing rigging checks safely.	✓	✓	✓
Aircraft Hydraulic and Pneumatic Systems	Identification and interpretation of fluid power component symbols: in depth analysis of issues in construction and testing of a fluid power circuit.	✓	✓	✓
Avionics: An Introduction	Identification and analysis of factors influencing aircraft instrumentation and avionics to assure demonstration of understanding of basic operating principles.	✓	✓	✓
Aircraft Maintenance	Determination of essential requirements of aircraft maintenance schedule, selection of appropriate resources and equipment and safe completion of work.	✓	✓	✓
Across the award candidates apply their knowledge to demonstrate understanding of the operation of systems and procedures on modern aircraft. They identify essential requirements in a range of situations and devise strategies for managing practical issues. They take an overview which takes into account relevant legislation and professional standards, selecting appropriate resources. techniques and methods. Health and safety requirements will underpin approaches to practical work. Discussion of technical issues and assessor feedback during formative work will reinforce reflective evaluation of problem solving.				

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Aeronautical Engineering Fundamentals	Graphics are presented accurately with clear annotation.		✓
Avionics: An Introduction	Clarification of relevance and significance of complex numerical and graphic information in basic principles of measuring altitude and airspeed.	✓	✓
Aircraft Power Plant	Interpretation of complex technical information from charts and diagrams; translating and applying graphic information in a practical context.	✓	✓
Aircraft Flight Controls	Static friction/linear/angular measurement explained in relation to setting flight controls and performing checks.	✓	✓
Theory of Flight	Investigation of main forces and force balance acting on aircraft in flight.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently to carry out a number of sustained, complex calculations and have to be able to apply data in practical aeronautical engineering contexts.			

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Aircraft Hydraulic and Pneumatic Systems	Formative research and group discussion on function and operation of a range of aircraft systems. Written descriptions to industry report standard.	✓	✓	✓
Aircraft Power Plant	APP-investigative work, accessing and evaluating technical data on the construction and operation of engines, engine accessories and fuel systems. Practical work develops oral communication skills in a work related context.	✓	✓	✓
Avionics: An Introduction	Formative discussion of principles and practice. Written/oral responses presenting complex information using appropriate terminology on the use, basic configuration and operating principles of radio communication systems in aviation.	✓	✓	✓
Detailed understanding and evaluation of statutory regulations and technical information is essential. Well presented written reports and responses will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include practical work with extensive discussion of aeronautical engineering practice. Candidates may also provide some evidence orally.				

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting –formal discussion, decision making and documentation.	✓	✓	✓	✓
Aircraft Maintenance	Practical inspection work provides an environment in which to work in groups, agree on security safety and monitor, review and evaluate the process.	✓	✓	✓	✓
Aircraft Power Plant	Practical formative work such as stripping down petrol engines and their accessories would develop team skills in a work related context.	✓	✓	✓	✓
Aviation Practice	Workshop manufacture or repair of an aircraft artefact to a given specification. Formative work will emphasise the essential role of team co-operation in promoting and implementing safe working practices.	✓	✓	✓	✓
Avionics: An Introduction	Underpinning theory outlining needs, strategies and techniques underpinning co-operative working with a range of others.	✓	✓	✓	✓

Learning activities will involve analysis and understanding of the essential nature of roles and responsibilities within the Aeronautical Engineering industry and the need for co-operation with a range of others. All practical tasks will develop team working skills and support the ability to form working relationships in vocational contexts. Assessor feedback on the individual's group working contributions will be on-going. Site visits will include observation of industry teamworking in a hangar environment.

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Aeronautical Eng. Fundamentals	Formative use of computer simulation software and practical experimental work. Investigative work and note taking.	✓	✓	✓	✓
Aircraft Hydraulic and Pneumatic Systems	Understanding of the principles of auto pilot system using computers to manoeuvre and stabilise aircraft.	✓	✓	✓	
Avionics: An Introduction	Research and reference checks. Use of flight simulator software to illustrate aircraft flight decks and systems	✓	✓	✓	✓
Aircraft Design	Design Software packages may be used to confirm design solutions	✓	✓	✓	✓
Access to the Internet will be used to research essential underpinning knowledge for the award and as a reference source for current technical information and advice. Flight simulation software will be used. On-line tutorial support should be available as needed and e-assessment including e-testing, the use of e-portfolios and e-checklists may be appropriate for some Units.					

National Certificate in Electrical Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

Numeracy is fundamental to the discipline of Electrical Engineering which requires the ability to translate, produce and apply complex data in graphic and numerical forms. Candidates learn to interpret diagrams and develop essential skills in the accurate calculation and measurement required in electrical fabrications, installations and testing. All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. Candidates identify, analyse and take into account all factors impacting on practical Electrical Engineering work. Diagrams and specifications are interpreted, and decisions made on methods, materials and techniques which take account of conditions and comply with regulatory and safety requirements. Effective implementation includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for formal review and evaluation.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Interpretation and communication of complex technical information in written and oral forms will be demonstrated by using examples of industry documentation to indicate acceptable formats, structure and terminology. Task based work and site visits will provide opportunities for observing industry practice and applying work related communication skills and promoting good team relationships to ensure the identification, management and resolution of any potential difficulties.

Information Technology is an essential tool for reference and research to ensure currency of knowledge. Skills may be further strengthened by access to a range of professional software packages. On line tutorial support and e-learning opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Electrical Principles	Identification, differentiation, and calculation of complex data essential in the creation of product evidence.	✓	✓
Cable Ratings and Over Current Devices	Calculation of minimum cable size to meet load conditions/ installation methods; inclusion of Correction factors.	✓	✓
Earthing and Earth Fault Current Protection	Complex calculations using BS7671 criteria-selection of conductors of appropriate sizes for installation conditions.	✓	✓
Installation of Conduit Systems	Accuracy in calculation and measurement in fabrication, assembly, installation of conduit systems. Interpretation of wiring requirements from circuit diagrams.	✓	✓
Electrical Power Systems	Interpretation of complex graphic information in charts, grid circuits and distribution feeder arrangements. Calculation of effects on system frequency and voltages under fluctuating load conditions.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently in completing sustained, complex calculations and applying data in practical electrical engineering contexts.			

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan, organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Electrical Plant Maintenance	Identification and analysis of all relevant factors in implementing safe working practices. Identification and reporting on electrical and mechanical faults.	✓	✓	✓
Electrical Testing and Measurement	Consideration of potential sources of error, selection of appropriate equipment, safe completion of testing and measurement.	✓	✓	✓
Inspection and Testing of Electrical Installations	Appraisal of specification, needs, statutory legislation and regulatory technical constraints before testing to industry standards.	✓	✓	✓
Illumination and Emergency Lighting	Investigation of lighting requirements to take account of room dimensions, working surface needs and maintenance before determining type and quantity of luminaries.	✓	✓	✓
Installation of Conduit Systems	Translation of given information to produce a wiring system, assemble fabricated sections and install and terminate the wiring for a lighting circuit.	✓	✓	✓
Across the award candidates have to identify essential requirements in situations and devise and apply strategies for managing a range of practical electrical engineering issues. They take an overview of specifications needs, taking into account relevant legislation and professional standards, and they select appropriate resources and methods. Health and safety requirements are adhered to throughout to completion; inspection and testing is standard practice.				

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Fundamental Electrical Systems	Formative research and group discussion on issues - formal report on all stages of electrical generation, transmission and distribution systems.	✓	✓	✓
Electrical Plant Safety and Maintenance	Investigation, identification and written/oral reporting on electrical and mechanical faults. Application of safety and technical information.	✓	✓	✓
Electrical Testing and Measurement	Records of practical electrical testing and measurement. Discussion of the process during practical work.	✓	✓	
Inspection and Testing of Electrical Installations	Application of understanding to undertake inspection and complete test documentation as provided in the BS7671 Wiring Regulations.	✓	✓	
Single and Three Phase Induction Motors	Investigation and discussion of operation. Written responses presenting complex information clearly and accurately, using appropriate terminology.	✓	✓	✓
Detailed understanding, evaluation and application of statutory regulations and technical information are essential. Well presented written information in workbooks will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include laboratory work and site visits which involve extensive discussion of electrical engineering practice. Candidates may also provide some evidence orally.				

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting –discussion, decision making and documentation.	✓	✓	✓	✓
Electrical Principles	Underpinning theory outlining needs, strategies and techniques of co-operative working with a range of others.	✓	✓	✓	✓
Electrical Testing and Measurement	Practical work provides an environment in which to work in groups, agree on security and safety and to monitor, review and evaluate the process.	✓	✓	✓	✓
Inspection and Testing of Electrical Installations	Formative work in laboratory conditions identifies the relevance of team co-operation in promoting and implementing safe working practices.	✓	✓	✓	✓
All practical tasks will develop team working skills and support the ability to form working relationships with a range of others in practical vocational contexts. Workshop activities will involve observation of industry practice in roles and responsibilities and encourage co-operation in group work. Assessor feedback on contributions will be routine.					

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Fundamental Electrical Systems	Accessing current background information to investigate and record detail of available power systems, sources and renewable energy issues.	✓	✓	✓	✓
Illumination and Emergency Lighting	Suitable Design Software packages may be used to confirm design solutions	✓	✓	✓	✓
Digitally Integrated Security and Environmental Control Systems	Underpinning investigation. Use of digital security and environmental control technology to familiarise with control and communication protocols and sub-systems required for control and management of integrated systems.	✓	✓	✓	✓
A number of practical options make use of software packages and simulations to confirm and produce design solutions. Access to the Internet will be used across the award to research essential underpinning knowledge and as a reference source for current technical information and advice. On-line tutorial support should be available as needed.					

National Certificate in Electronic Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the general competencies developed in the award. As each practical activity is undertaken candidates have to identify and analyse a range of factors impacting on best practice in Electronic Engineering. Decisions are made on materials, techniques and methods to comply with regulatory and safety requirements as candidates work to a given brief. Analysis and evaluation of requirements and limitations, with management of a process through to the completion and testing of product simulates typical industrial processes. Implementation includes the ability to adapt and modify approaches and record decision making in workbooks. Inspection and testing provides opportunities for assessor feedback and the formal review and evaluation of solutions. *Numeracy* is fundamental to the discipline of Electronic Engineering with the need to analyse, convert, apply and produce complex information using number and graphics. Candidates have to be able to work confidently with a number of complex numerical and graphic concepts. As they apply and clarify theory to solve problems they interpret and represent complex information in appropriate formats. The focus of formative activities is on Numeracy as a tool to be used critically in practical engineering contexts.

Access to *Information Technology* is essential to ensure currency of underpinning knowledge. Skills are strengthened by the availability of a range of professional computer-aided design programs and on line tutorial support. On line tutorial support and e-learning opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation and communication of complex technical information in written and oral forms will be demonstrated by using examples of industry documentation to indicate acceptable formats, structure and terminology. Task based work and site visits will provide opportunities for applying work related communication skills and promoting good team relationships to ensure the identification, management and resolution of any potential difficulties.

Approaches to skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 6)

Critical Thinking

- Analyse a complex situation or issue

Planning and Organising

- Plan organise and complete a complex task

Reviewing and Evaluating

- Review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Application of Programmable Logic Controllers	Analysis and evaluation of requirements and limitations in the development of the design of a PLC program. Management through to the completion and testing of product simulating a typical industrial process.	✓	✓	✓
Combinational Logic	Identification and analysis of all relevant factors in investigations, correct construction and testing.	✓	✓	✓
Electronic Test Equipment and Measurement	Setting up of electronic test equipment, selection of techniques for performing measurements; verification and testing to the given specification.	✓	✓	✓
Fundamental Electronics	Interpretation of device specifications, selection of appropriate device for a particular application. Circuit construction, assembly and functional testing of circuits.	✓	✓	✓
Power Supplies	Features of design influencing performance and usefulness are considered before candidates demonstrate the operation of regulated power supplies and use of appropriate test equipment.	✓	✓	✓
Across the award candidates have to identify essential limitations and devise and justify strategies, techniques and equipment for dealing with a range of practical issues. Consideration of and adherence to professional standards, relevant legislation and health and safety requirements is standard. Testing involves evaluation of process and product. Assessor feedback encourages reflective review of achievement.				

Numeracy (SCQF level 6)

Using Number

- Apply in combination a wide range of numerical and other mathematical skills to process complex information

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information

Unit	Knowledge/Skills/Evidence	UN	UGI
Mathematics: Technician 1	Numerical and graphical information is interpreted and communicated in a specialised context.	✓	✓
Combinational Logic	Investigation of the logical characteristics of arithmetic and data conversion circuits; extending the applications of digital electronics devices and techniques to using MSI devices	✓	✓
Electronic Network Analysis	Application of a range of circuit analysis techniques to solve circuit values.	✓	✓
Semiconductor Applications	Investigation of device characteristics, parameters and applications; measurements and calculations for a range of circuits. Communication of input and output signals.	✓	✓
Sequential Logic	Translation of information in diagrams, application notes and device data sheets; development of functional diagrams, determination of test specifications.	✓	✓
The ability to interpret, apply and communicate complex numerical and graphical information is integral to achievement. Fundamental calculations, measurements and the skills of device recognition and selection are applied to electrical and related subjects. Data is determined, analysed, calculated and presented accurately, using number, symbols, sketches, diagrams and graphs.			

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- Use a range of IT equipment paying attention to security and other users
- Resolve a simple hardware or software problem
- Use software in an unfamiliar context requiring analysis, design, integration of data
- Carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	Searches for technical information. Interpretation and production of data using professional software packages and applications.	✓	✓	✓	✓
Application of Programmable Logic Controllers	Design of a PLC program that simulates a typical industrial process. Use of professional hardware and software representative of those used to control industrial processes.	✓	✓	✓	✓
Communication	Internet research on sustainability concerns, history, materials and case studies could contribute to essential underpinning knowledge.	✓		✓	✓
Investigative research on current technical information and professional guidance will be enhanced by access to the Internet to provide essential underpinning knowledge for the award. Use of software to manipulate and integrate written and graphic data will be routine. On line guidance and tutorial support will be available as needed. Security, consideration for other users and the managing of minor technical problems will be an aspect of good practice.					

Communication (SCQF level 6)

Written (Reading and Writing) and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Application of Programmable Logic Controllers	Investigation. Critical review of design process and product with supporting correctly annotated graphics. Workbook records and tests. Oral presentation of planning information.	✓	✓	✓
Combinational Logic	Underpinning theory and Safety regulations and requirements. Construction details, test methods and results fully detailed and recorded in the workbook.	✓	✓	✓
Power Electronics	Awareness and understanding of factual information, current theories and related industry developments. Detailed awareness of the full range of relevant Standards and Legislation essential to industry practice. Structured responses. Formative demonstration and discussions.	✓	✓	✓
Understanding, evaluation and application of technical literature and statutory regulations. Well presented written information in workbooks. Oral/written evidence will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative work involves extensive discussion of the concepts and practice associated with electronic engineering. Candidates may also provide evidence orally, using a range of verbal and non-verbal communication techniques and terminology which will meet the needs of employers.				

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete an activity

- Analyse the activity and identify component tasks and roles
- Agree allocation of activities taking account of group strengths and weaknesses
- Support co-operative working
- Evaluate and draw conclusions about own contribution, justifying with evidence

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Working relationships in team meetings and decision making are assessed.	✓	✓	✓	✓
Application of Programmable Logic Controllers	Formative activities provide opportunities to practise workplace team roles and responsibilities with assessor guidance in analysing design needs.	✓	✓	✓	✓
Electronic Test Equipment and Measurement	Practical activities include demonstration and support in a working environment, negotiating agreement on team contributions to safety, monitoring and evaluation of progress.	✓	✓	✓	✓
Power Electronics	Practical laboratory work provides an environment in which to explore, learn and work co-operatively in teams.	✓	✓	✓	✓
Small group investigative and experimental activities as part of formative work will support candidates, particularly those with no industry experience. All practical tasks and industry visits will develop team working skills and provide ways to enhance positive working relationships with a range of others in vocational contexts. Feedback from assessors on effective group working practice will be on going.					

National Certificate in Fabrication and Welding Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates identify, analyse and take into account all factors which affect materials and processes. Specifications are interpreted, and decisions made on the selection of methods and materials to comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for formal review and evaluation of achievement. *Numeracy* is fundamental to the discipline of Engineering which requires the ability to interpret, produce and apply complex data in graphic and numerical forms. Candidates learn skills in the practical translation, calculation and presentation of information in practical working situations.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation and communication of complex technical information in written and oral forms will be demonstrated by using examples of industry documentation to indicate acceptable formats, structure and terminology. Task based work and site visits will provide opportunities for applying work related communication skills and promoting good team relationships to ensure the identification, management and resolution of potential difficulties.

Information Technology is an essential tool for reference and research to ensure currency of knowledge. Skills are further strengthened by access to a range of professional software packages. On line tutorial support and e-learning opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Pattern Development	Identification of critical requirements. Determining all factors affecting and applying the information to produce patterns for fabricated components and assemblies.	✓	✓	✓
Fabrication Processes	Theoretical understanding of principles, procedures and processes for the manufacture of a fabricated component to include opportunities formative and integrated practical work.	✓	✓	✓
Thermal Cutting Processes	Decision making on appropriate equipment and consumables required for the thermal cutting processes; identification of factors affecting selection of a thermal cutting process for a given application.	✓	✓	✓
Welding: Procedures and Specifications	Identification and analysis of all relevant factors in assessing weldability. Implementing safe working practices during welding. Checking and reporting on results.	✓	✓	✓
Engineering Project	Creation of a project plan to achieve stated objectives, manufacture of product in accordance with the planned activities, documentation and completion of deliverables.	✓	✓	✓
Across the award candidates have to identify essential requirements in situations and devise and apply strategies for managing a range of practical fabrication and welding engineering issues. They take an overview of specifications needs, taking into account relevant legislation and professional standards, and they identify and select appropriate resources and techniques. Health and safety requirements are considered in all practical work; inspection and testing is standard practice with assessor feedback to support evaluation of achievement.				

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Welding: Procedures and Specifications	Interpretation and application of written and graphic information relevant to specification and testing; drawing up/determining ranges of approval and testing requirements for weld procedures and welder qualifications.	✓	✓
Graphical Engineering Communication	Interpretation of engineering documentation; creation of two-dimensional engineering detail and assembly drawings.	✓	✓
Shipbuilding Technology	Analytical evaluation of the effect of forces on assemblies during ship construction and launching, and structural stresses on vessels at sea.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently in completing sustained, complex calculations and applying data in practical engineering contexts.			

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Engineering Materials	Formative research and evaluation of complex technical data. Formative group discussion on issues — formal responses.	✓	✓	✓
Welding Processes	Analytical written work which is factually and technically accurate, and presented to a standard acceptable in the vocational area.	✓	✓	✓
Welding Procedures and Specifications	Records of practical testing completed using vocational terminology/formats. Oral communication with others during practical work.	✓	✓	✓
Engineering Project	Investigation and background research. Documented data and information presented and structured in accordance with project exemplar/guidelines.	✓	✓	✓
Detailed understanding, evaluation and application of statutory regulations and technical information is essential. Well presented written information in workbooks will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include workshop practice which involves extensive discussion of professional issues and concerns. Candidates may also provide some evidence orally.				

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting — discussion, decision making and formal documentation.	✓	✓	✓	✓
Fabrication Processes	Underpinning theory outlining needs, strategies and techniques of co-operative working with a range of others.	✓	✓	✓	✓
Welding: Procedures and Specifications	Workplace conditions require team co-operation in promoting and implementing safe working practices.	✓	✓	✓	✓
Engineering Project	Practical work provides an environment in which to work in groups, agree on security and safety and to monitor, review and evaluate the process.	✓	✓	✓	✓
All practical tasks will develop team working skills and support the ability to form working relationships with a range of others in practical vocational contexts. Workshop activities will and industry visits involve observation of industry practice in team roles and responsibilities and will develop co-operation with others. Assessor feedback on contributions will be on-going.					

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Graphical Engineering Communication	Creation of two-dimensional engineering detail and assembly drawings using software packages to confirm design solutions.	✓	✓	✓	✓
Thermal Cutting Processes	Underpinning knowledge — Access to a range of current resources on materials/issues relevant to thermal cutting processes.	✓			✓
Communication	Accessing current background information to investigate and record detail of Outcome 2 vocational report. Production of extended responses/meeting documentation to professional standards.	✓	✓	✓	✓
A number of practical options make use of software packages and simulations to confirm and produce solutions and offer experience. Access to the Internet will be used across the award to research essential underpinning knowledge and as a reference source for current technical information and advice. E- learning is increasingly available, and on-line tutorial support should be available as needed.					

National Certificate in Manufacturing Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed in the award. As each Unit is undertaken candidates identify, analyse and take into account all factors impacting on practical Engineering work. Specifications are interpreted, and decisions made on methods and materials to comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for formal review and evaluation of achievement.

Numeracy is fundamental to the discipline of Manufacturing Engineering which requires the ability to translate, produce and apply complex data in graphic and numerical forms. Candidates learn skills in the practical interpretation, calculation and presentation of qualitative and quantitative data in work related contexts.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation and communication of complex technical information in written and oral formats will be demonstrated. Examples of industry documentation will be used to indicate acceptable formats, structure and terminology in written communication. Workshop activities and site visits will provide opportunities for applying work related communication skills and promoting good team relationships to ensure the identification, management and resolution of any potential difficulties.

Information Technology is an essential tool for reference and research to ensure currency of knowledge. Skills are further strengthened by access to a range of professional software packages. On line tutorial support and e-learning opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Engineering Assembly Skills	Appraisal of specification, needs, statutory legislation and regulatory technical constraints before risk assessment. Completion of assemblies fault diagnosis and correction.	✓	✓	✓
Engineering Dimensional Control	A range of complex measurements on engineering components is undertaken, recorded and checked.	✓	✓	✓
Industrial CNC Machining	Interpretation of component drawing, selection of material and tooling requirements, use of safe methods and techniques to set tool offsets and run programs. Fault finding and correction of program errors after component inspection to identify any non-conformance.	✓	✓	✓
Materials Removal Practice: Milling/Turning	Planning to analyse requirements. Selection of specialist equipment, methods and techniques needed to manufacture components safely from a given engineering drawing. Results are inspected and checked.	✓	✓	✓
Engineering Workshop Skills	Planning schedule including identification and analysis of all relevant factors. Components are prepared, marked out, manufactured, assembled and checked.	✓	✓	✓
Across the award candidates have to identify essential requirements and devise and apply strategies for managing a range of practical fabrication and welding engineering issues. They take an overview of requirements taking into account relevant legislation and professional standards, and they select appropriate approaches, resources and methods. Health and safety requirements are adhered to throughout to completion; inspection and testing is standard practice with assessor feedback to support evaluation of achievement.				

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Engineering Systems	Interpretation and representation of engineering systems in block diagram form. Calculations different forms of mechanical and electrical energies, energy losses and overall efficiency in an engineering system.	✓	✓
Engineering Dimensional Control	A range of complex measurements on components is undertaken, recorded and checked.	✓	✓
Engineering Material Removal Principles	Interpretation of graphic and written information on tools, materials and conditions to inform accurate calculations and determine speeds and feeds for cutting tools and materials.	✓	✓
Engineering Workshop Skills	Interpretation and application of written and graphic information relevant to specification and testing; drawing up/determining ranges of approval and testing requirements.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently in completing sustained, complex calculations and applying data in practical engineering contexts.			

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Engineering Manufacturing Processes	Investigation and background research. Analysis, summary and communication of complex technical information on traditional and current manufacturing processes.	✓	✓	✓
Engineering Workshop Skills	Risk Assessment report and records of practical testing completed using vocational terminology/formats. Oral communication with others during practical work.	✓	✓	✓
Engineering Assembly Skills	Evaluation and application of information on statutory legislation and regulatory technical constraints before risk assessment. Records of testing. Co-operative communication in advising and informing others orally.	✓	✓	✓
Detailed understanding, evaluation and application of statutory regulations and technical information is essential. Well presented written information in workbooks will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include workshop practice which involves extensive discussion of professional issues and concerns. Candidates may also provide some evidence orally.				

Working with Others (SCQF level 6)

Work with Others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting — discussion, decision making and formal documentation.	✓	✓	✓	✓
Engineering Manufacturing Processes	Underpinning theory outlining needs, strategies and techniques of co-operative working with a range of others.	✓	✓	✓	✓
Engineering Workshop Skills	Workplace conditions require team co-operation in promoting and implementing safe working practices.	✓	✓	✓	✓
Engineering Assembly Skills	Practical work provides an environment in which to work in groups, agree on security and safety and to monitor, review and evaluate the assembly process.	✓	✓	✓	✓
All practical tasks will develop team working skills and support the ability to form working relationships with a range of others in practical vocational contexts. Workshop activities will involve observation of industry practice in roles and responsibilities and will develop co-operation with others in group work. Assessor feedback on contributions will be routine. An optional dedicated Core Skill Unit is also included in the framework.					

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Communication	Accessing current background information to investigate and record detail of Outcome 2 vocational report. Production of extended responses/meeting documentation to professional standards.	✓	✓	✓	✓
Engineering Manufacturing Processes	Underpinning knowledge — Access to a range of Internet resources on materials/issues relevant to traditional and non-traditional manufacturing processes.	✓	✓	✓	✓
Industrial CNC Machining	Loading of programs for CNC machines/lathes, carrying out basic fault finding and correction, modifying as necessary and saving changes.	✓	✓	✓	✓
Computer Aided Draughting	Use of software CAD packages to industry standard.	✓	✓	✓	✓
Access to the Internet will be used across the award to research essential underpinning knowledge and as a reference source for current technical information and advice. On-line tutorial support and e-learning opportunities should be available as appropriate.					

National Certificate in Measurement and Control Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating — underpin the competencies developed in the award. As each Unit is undertaken candidates identify, analyse and take into account all factors impacting on practical Engineering work. Specifications are interpreted, and decisions made on working methods and approaches to comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for formal review and evaluation of achievement.

Numeracy is fundamental to the discipline of Manufacturing Engineering which requires the ability to translate, produce and apply complex data in graphic and numerical forms. Candidates learn skills in the practical interpretation, calculation and presentation of qualitative and quantitative data in work related contexts.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation and communication of complex technical information in written and oral forms will be demonstrated. Examples of industry documentation will be used to indicate acceptable formats, structure and terminology in written communication. Task based work and site visits will provide opportunities for applying work related oral communication skills and promoting good team relationships to ensure the identification, management and resolution of potential difficulties.

Information Technology is an essential tool for reference and research to ensure currency of knowledge. Skills are further strengthened by access to a range of professional software and simulation packages. On line tutorial support and e-learning opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Approaches to the skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Engineering: Measurement Technology — Flow	Characteristics of flow measurement systems and their effects are fully analysed. Influence of installation and environmental factors is taken into account before calibration data is measured, checked and recorded.	✓	✓	✓
Engineering: Process Control Systems	Investigations are undertaken prior to the setting up and operating of a process control system with a range of control actions.	✓	✓	✓
Engineering: Distributed Control Systems	Consideration of ambient temperature and pressure variations, head effects due to position, and density changes underpin working efficiently and safely to complete practical measurements.	✓	✓	✓
Applications of Programmable Logic Controllers	Planning and preparation for the operation of a **PLC** programme; creation of **PLC** programmes to control typical industrial related processes.	✓	✓	✓
Engineering: Signal Conditioning in Telemetry	Identification and explanation of significant factors before safe setting up of measurement equipment and determining signal changes in measurement and control engineering systems.	✓	✓	✓
Across the award candidates have to identify essential requirements in situations and devise and apply strategies for managing a range of practical engineering issues. They take an overview of specifications needs, taking into account relevant legislation and professional standards, and they select appropriate resources and methods. Health and safety requirements are adhered to throughout. Discussing, practising and evaluating engineering processes in a laboratory environment will be routine in formative work with assessor feedback to support evaluation of achievement.				

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Engineering Measurement Technology: Pressure/level	Candidates perform, interpret and present a series of complex calculations and measurements as they complete calibration checks on two measurement systems.	✓	✓
Engineering: Process Control Systems	Working in a measurement and control engineering laboratory with a range of process control systems, candidates use ICT equipment to demonstrate understanding of process control systems optimisation.	✓	✓
Engineering: Distributed Control Systems	A range of complex measurements on components is undertaken, recorded and checked as candidates demonstrate knowledge and understanding of systems and their application in process measurement and control.	✓	✓
Engineering: Complex Control Systems	Numeracy skills, particularly in using graphic information, will be naturally enhanced, with practical analysis of data as candidates interpret and explain a series of pipe and measurement diagrams.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently in completing sustained, complex calculations, plotting graphs and applying data in practical contexts.			

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Engineering Measurement Technology: Flow, Pressure/level. Temperature	Short reports and records of practical testing completed using vocational terminology/formats. Reading specifications. Oral communication with others during practical work.	✓	✓	✓
Engineering: Distributed Control Systems	Evaluation of technical information. Risk Assessment report and records of practical testing completed using vocational terminology/formats. Oral communication with others during practical work.	✓	✓	✓
Engineering: Signal Conditioning in Telemetry	Evaluation and summary of information on different types of signal conditioning and communication. Short Reports, including graphic communication.	✓	✓	✓
Engineering: Hazards, Protection Methods and Functional Safety	Evaluation of technical information on different types of detectors, barriers and emergency shutdown controllers. Analysis, summary and communication of complex technical information in accurate written/oral responses.	✓	✓	✓

Detailed understanding, evaluation and application of statutory regulations and technical information is essential. Well presented technical reports will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include laboratory work which will involve extensive discussion of industry issues. Candidates may also provide some evidence orally.

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting — discussion, decision making and formal documentation.	✓	✓	✓	✓
Engineering: Process Control	Underpinning knowledge emphasises needs, strategies and techniques of co-operative working with a range of others.	✓	✓	✓	✓
Engineering: Process Control Systems	Work takes place in a measurement and control engineering laboratory promoting and implementing safe working practices with a range of process control systems, test and ICT equipment.	✓	✓	✓	✓
Engineering: Signal Conditioning in Telemetry	Practical work provides an environment in which to agree on security and safety and to monitor, review and evaluate approaches to team working with measurement and control systems.	✓	✓	✓	✓
All practical tasks will develop team working skills and support the ability to form working relationships with a range of others in practical vocational contexts. Workshop activities will involve observation of industry practice in roles and responsibilities and will develop co-operation with others in group work. Assessor feedback on contributions will be routine. An optional dedicated Core Skill Unit is included in the framework.					

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Communication	Accessing current background information to investigate and record detail of Outcome 2 vocational report. Production of extended responses/meeting documentation to professional standards.	✓	✓	✓	✓
Engineering: Process Control Systems	Work takes place in a measurement and control engineering laboratory with a range of process control systems, test and ICT equipment.	✓	✓	✓	✓
Engineering: Distributed Control Systems	DCS Candidates investigate the achievement of process measurement and control with a data highway and Local Area Network (LAN). Access to on line information on different types of DCS and SCADA systems.	✓	✓	✓	✓
Signal Conditioning in Telemetry	Formative use of simulation software. Access to internet researching information on different types of signal conditioning and communication equipment from current web-sites.	✓	✓	✓	✓
Access to the Internet will be used across the award to research essential underpinning knowledge and as a reference source for current technical information and advice. On-line tutorial support and e-learning opportunities should be available as needed. There are a number of optional Units in the award which encourage the use of simulation software.					

National Certificate in Mechanical Engineering (SCQF level 6)

Opportunities for Core Skills development

The award includes mandatory Units in Mathematics, *Information Technology* and *Communication* which are contextualised to ensure Core Skill competence tailored to vocational needs. Centres will build on entry skills diagnostic profiling for the on-going development across the award of relevant aspects of all five Core Skills.

Numeracy is fundamental to the discipline of Mechanical Engineering. Candidates learn skills in the practical interpretation, calculation, application and presentation of complex data in graphic and numerical form. Opportunities to develop sound knowledge, understanding and skills are assured by setting the concepts, principles and laws within a practical Mechanical Engineering context and by encouraging candidates to solve realistic engineering problems. All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning and Organising, Reviewing and Evaluating underpin the competencies developed. As each Unit is undertaken candidates identify, analyse and take into account all factors impacting on practical Mechanical Engineering work. Practical laboratory experiments are part of formative work in order to relate theory learnt in the classroom to practice. Specifications are interpreted, and decisions made on methods and approaches which comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify techniques as necessary. Inspection and testing provide opportunities for formal review and evaluation of achievement.

Ways of enhancing skills in *Communication* and *Working with Others* are explored in work related contexts. Effective interpretation and communication of complex technical information in written and oral forms will be demonstrated by using examples of industry documentation to indicate acceptable formats, structure and terminology. Task based work and site visits will provide opportunities for applying work related communication skills and promoting good team relationships to ensure the identification, management and resolution of any potential difficulties.

Information Technology is an essential tool for reference and investigative research to ensure currency of knowledge. Skills may be further strengthened by access to a range of simulation packages and professional software. On line tutorial support with e-learning and e-assessment opportunities are increasingly available. Responsible and secure use of equipment and consideration of the needs of other users will be routine.

Approaches to skills are detailed in individual Unit specifications. Some examples of development opportunities across the award, with a focus on core Units, are mapped in the following grid.

Numeracy (SCQF level 6)

Using Number

- Apply a wide range of numerical, statistical and other mathematical skills in generalised contexts
-

Using Graphical Information

- Apply a wide range of graphical skills to interpret and present complex information in generalised contexts

Unit	Knowledge/Skills/Evidence	a	b
Mathematics: Technician 1	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓
Engineering Design	The ability to interpret, calculate and translate numerical and graphical data is essential in meeting design briefs. Design solutions are calculated and presented using sketches and engineering drawings.	✓	✓
Engineering Dynamics: An Introduction	Candidates manipulate and evaluate equations as they solve problems in engineering dynamics; they interpret and translate information from diagrams.	✓	✓
Engineering Dynamics	Problems involving velocity vector diagrams and centripetal and centrifugal forces are solved. The principle of the conservation of momentum is applied to solve linear dynamic problems.	✓	✓
Power Drives	Interpretation of manufacturers' graphic and written data informs accurate calculation of technical factors when designing and selecting power transmission products.	✓	✓
Engineering Systems	Engineering systems are calculated and represented in block diagram form. Calculations of different forms of mechanical and electrical energies, energy losses and overall efficiency in an engineering system.	✓	✓
The ability to interpret, translate and convey complex graphical and numerical information accurately and independently is integral to achievement across the award. Candidates have to work confidently in interpreting and sketching diagrams. They complete sustained, complex calculations and apply data in mechanical engineering contexts.			

Problem Solving (SCQF level 6)

Critical Thinking

- analyse a complex situation or issue

Planning and Organising

- plan organise and complete a complex task

Reviewing and Evaluating

- review and evaluate a complex problem solving activity

Unit	Knowledge/Skills/Evidence	CT	PO	RE
Engineering Design	Analysis of client requirements and key design factors including format to develop several potential designs. Justification and development of optimum solution.	✓	✓	✓
Power Drives	Evaluation of a range of mechanical power transmission products to determine capability, capacity and suitability for given applications. Design of a mechanical power transmission drive; awareness of checking methods.	✓	✓	✓
Statics	Understanding of properties and effects of the application of force on a body, component or structure is applied to solve a range of technical problems.	✓	✓	✓
Engineering Dynamics	Problem solving involving interpretation of velocity vector diagrams, Application of the principle of the conservation of momentum to the solution of linear dynamic problems.	✓	✓	✓
As they undertake the award candidates have to identify and consider principles and characteristics in engineering before they devise strategies for managing a range of mechanical engineering issues. Understanding of engineering concepts, laws and principles is applied to solve problems; workshop activities raise awareness of professional standards, legislative constraints and practical Health and Safety requirements. Assessors encourage reflective review and evaluation. Industrial visits encourage discussion with engineers on site on the practical handling of challenges in mechanical engineering.				

Communication (SCQF level 6)

Reading, Writing and Oral

- Read and evaluate complex written communication
- Produce well-structured written communication on a complex topic
- Produce and respond to oral communication on a complex topic

Unit	Knowledge and Skills/Evidence	R	W	O
Communication	Analytical responses and summary of complex text. Production of 750 word investigative formal report. Outcome 3: Formal meeting, procedures and administrative record keeping for decision making.	✓	✓	✓
Engineering Design	Evaluation and application of technical data in design brief. Discussions with "design team". Summary of complex technical information and data in design specification to industry standards	✓	✓	✓
Power Drives	Understanding, evaluation and application of manufacturer's technical literature; Written reporting, explanation and parts list. Formative discussions.	✓	✓	✓
Engineering Project	Investigation and background research, including oral reporting to assessors. Documented data and information presented and structured in accordance with project exemplar/guidelines.	✓	✓	✓
Detailed understanding, evaluation and application of technical information is essential and candidates will read and apply technical data from paper based and electronic sources, including manufacturers' materials, wall charts and handouts. Written reports and support documentation will be to the standards required within the vocational area, with accurate use of terminology and clearly annotated supporting graphics. Formative activities include workshop practice with extensive discussion of industry issues. Candidates may also provide some evidence orally.				

Working with Others (SCQF level 6)

Work with others in a group to analyse, plan and complete a complex activity

- analyse task and identify components
- negotiate goals, roles and responsibilities taking account of strengths and weaknesses of the group
- support co-operative working
- evaluate and draw a conclusion about own contribution and justify

Unit	Knowledge/Skills/Evidence	a	b	c	d
Communication	Outcome 3: Group meeting — discussion, decision making and formal documentation.	✓	✓	✓	✓
Engineering Design	Candidates form into design teams while undertaking design exercises in Outcome 2 and use appropriate group idea generation methods to develop a range of solutions to design problems.	✓	✓	✓	✓
Power Drives	Underpinning theory outlining needs, strategies and techniques of co-operative working with a range of others in design of a mechanical power transmission drive.	✓	✓	✓	✓
Engineering Project	Practical work provides an environment in which to work in groups, agree on security and safety and to monitor, review and evaluate the process of project work. Workplace conditions require team co-operation in promoting and implementing safe working practices.	✓	✓	✓	✓
Formative work will involve laboratory experiments to relate theory learnt to practice and develop team working skills to support the ability to form working relationships with a range of others in vocational contexts. Industrial visits will involve observation and discussion of industry practice, roles and responsibilities and will develop co-operation with others in group activities. Assessor feedback on contributions to team working will be routine. A dedicated Core Skill Unit option is included in the award framework.					

Using Information Technology (SCQF level 6)

Use an IT system independently to process a range of information

- use a range of IT equipment paying attention to security and other users
- resolve a simple hardware or software problem
- use software in an unfamiliar context requiring analysis, design, integration of data
- carry out searches to extract and present information from electronic sources

Unit	Knowledge/Skills/Evidence	a	b	c	d
Engineering: Applying Information Technology	The Core Skill is fully developed through achievement of this dedicated Unit.	✓	✓	✓	✓
Communication	Accessing current background information to investigate and record detail of Outcome 2 vocational report. Production of extended responses/meeting documentation to professional standards.	✓	✓	✓	✓
Thermofluids	Computer simulation illustrating different thermofluid concepts and principles could be used.	✓	✓	✓	
Strength of Materials	Underpinning knowledge — Access to a range of current resources on materials/issues relevant to manufacturing processes.	✓	✓	✓	✓
Engineering Design	Access to professional software packages to raise awareness of industry design standards.	✓	✓		✓
Access to the Internet will be used to research essential underpinning knowledge and as a reference source for current technical information and advice. Use of simulation software is recommended in several Units. On-line tutorial support should be available as needed and e-assessment including e-testing, the use of e-portfolios and e-checklists may be appropriate for some Units.					

Appendix 2: Alignment of NQ Engineering Units with National Occupational Standards

NQGA — Fabrication and Welding Engineering

Alignment to National Occupational Standards (NOS)

Table 1 indicates SVQ Units used in the mapping exercise.

Table 1: NOS — Fabrication and Welding		
Ref.	**NOS No.**	**Unit Title**
1	FEW 2. 01	Complying with Statutory Regulations and Organisational Safety Requirements
2	FEW 2. 02	Using and Interpreting Engineering Data and Documentation
3	FEW 2. 03	Working Effectively and Efficiently in Engineering
4	FEW 2. 04	Joining Materials by the Manual Metal Arc Welding Process
5	FEW 2. 05	Joining Materials by the Manual MIG/MAG & other Continuous Wire Processes
6	FEW 2. 06	Joining Materials by the Manual TIG & Plasma Arc Welding Processes
7	FEW 2. 08	Produce Fillet Welded Joints using a Manual Welding Process
8	FEW 2. 21	Marking Out Components for Fabrication
9	FEW 2. 22	Cutting Sheet Metal to Shape Using Hand and Machine Tools
10	FEW 2. 23	Forming Sheet Metal Using Hand and Machine Tools
11	FEW 2. 24	Producing Sheet Metal Assemblies
12	FEW 2. 32	Cutting Plate and Sections Using Shearing Machines
13	FEW 2. 34	Cutting and Shaping Materials Using Gas Cutting Machines
14	FEW 2. 36	Bending and Forming Plate Using Power Operated Machines
15	FEW 2. 37	Forming Platework Using Power Rolling Machines
16	FEW 2. 38	Producing Platework Assemblies
17	FEW 2. 42	Assembling Structural Steelwork
18	FEW 3. 22	Developing and marking Out Templates for Metalwork
19	WE 2001. 3	Establishing Welding and Fabrication Requirements for the Design Brief
20	WE 2001. 6	Specifying Welding Processes, Procedures & Controls to Achieve Production Requirements
21	045NTES 51	Implementing Quality Control Systems & Procedures in an Engineering Environment

NQGA Fabrication & Welding Engineering (L6)																						
National Occupational Standards																						
Unit Title	**Core/Option**	**level**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
Mathematics	CC	6		X		X	X	X	X	X			X	X	X			X	X	X	X	X	
Information Tech.	CC	6	X	X																X			
Communications	CC	6	X	X	X								X					X	X	X	X	X	X
Fabrication Processes	MC	6	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X
Welding Processes	MC	6	X	X	X	X	X	X	X												X	X	X
Engineering Project	RC	6	X	X	X																X	X	X
Engineering Materials	RC	6	X	X	X	X	X	X							X					X			
Pattern Development	RC	6	X	X	X					X			X					X		X	X		X
Thermal Cutting Processes	RC	6	X	X	X										X						X		X
Weld Procedures, Specs. & Testing	RC	6	X	X	X	X	X	X	X				X					X	X			X	X
Engineering Drawing	RC	6		X	X					X										X		X	X
NQGA Fabrication & Welding Engineering Practice (L5)																							
Mathematics	CC	5		X		X	X	X	X	X			X	X	X			X	X	X	X	X	
Information Tech.	CC	5	X	X																X			
Communications	CC	5	X	X	X								X					X	X	X	X	X	X
Fabrication Processes	MC	5	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X
Welding Processes	MC	5	X	X	X	X	X	X	X												X	X	X
Health & Safety: Eng	MC	5	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	
Engineering Project	RC	5	X	X	X																X	X	X
Engineering Materials	RC	5	X	X	X	X	X	X							X					X			
Pattern Development	RC	5	X	X	X					X			X					X		X	X		X
MIG/MAG Weld Skills	RC	6	X	X	X		X		X												X	X	X
Thermal Cutting Skills	RC	5	X	X	X										X						X		X

C = COMMON CORE **MC = MANDATORY CORE** **RC = RESTRICTED CORE**

NQGA — Measurement and Control Engineering

Alignment to National Occupational Standards (NOS).

The National Occupational Standards were developed by OPITO and approved in February 2004.

Table 1 indicates SVQ units used in the mapping exercise.

Table 1: NOS — Process Engineering Maintenance (Instrument and Control)		
	NOS – Reference	**Unit Title**
1	C2.1	Reinstate work area after completing the maintenance of process plant and equipment.
2.	C2.2	Handover Process Plant and equipment
3.	C2.3	Deal with hazards
4.	C2.4	Contribute to effective working relationships in process engineering maintenance.
5.	I 2.1	Carry out planned maintenance procedures on instrument and control plant and equipment.
6.	C2.5	Prepare work areas for the maintenance of process plant and equipment.
7.	I2.2	Prepare materials for the maintenance of instrument and control process plant and equipment.
8.	I2.3	Prepare process plant and equipment in support of instrument and control engineering activities.
9.	C2.6	Prepare loads for moving.
10.	C2.7	Move loads
11.	I 2.4	Assemble components of instrument and control process plant and equipment.
12.	I 2.5	Remove components from instrument and control process plant and equipment.
13.	I 2.6	Replace components in instrument and control process plant and equipment.

NQGA – Measurement and Control Engineering																
			National Occupational Standards													
Unit Title	**Core/Option**	**level**	1	2	3	4	5	6	7	8	9	10	11	12	13	
Communications	CC	6	X	X		X	X	X	X	X	X	X		X	X	
Information Tech.	CC	6	X	X		X	X	X			X			X	X	
Maths/Numeracy	CC	6		X			X		X	X				X		
Measurement: Technology Flow	RC	6		X			X		X	X			X	X		
Measurement: Technology Pressure/level	R C	6		X			X		X	X			X	X		
Measurement: Technology Temperature	RC	6		X			X		X	X			X	X		
Process Control	RC	6		X	X		X		X	X				X		
Process Control Systems	RC	6		X	X		X		X	X				X		
Distributed Control Systems	RC	6		X	X		X		X	X				X		
Programmable Logic Controllers	RC	6		X			X		X	X				X		
Signal Conditioning in Telemetry	RC	6		X			X		X	X				X		
Complex Control Systems	Option	6		X					X	X				X		
Process Analysers	Option	6		X	X		X		X	X			X	X		
Control Valves and Positioners	Option	6		X			X		X	X	X	X	X	X	X	
Hazards, Protection Methods and Functional Safety	Option	6	X	X	X	X	X		X	X	X	X	X			
Fault Finding in Measurement and Control	Option	6		X	X		X		X				X			
Combinational Logic	Option	6							X				X			
Electrical Fundamentals	Option	6							X							

C = COMMON CORE **MC = MANDATORY CORE** **RC = RESTRICTED CORE**

NQGA – Measurement and Control Engineering (cont)																
Unit Title	**Core/Option**	**level**	1	2	3	4	5	6	7	8	9	10	11	12	13	
Hazards, Protection Methods and Functional Safety	Option	6	X	X	X	X	X		X	X	X	X	X			
Fault Finding in Measurement and Control	Option	6		X	X		X		X				X			
Combinational Logic	Option	6							X				X			
Electrical Fundamentals	Option	6							X							
Project	Option	6		X					X							

NQGA — Electronics levels 5 and 6

Alignment to National Occupational Standards (NOS)

Table 1 indicates units used in the mapping exercise

NOS: Electrical and Electronic Engineering level 3

NVQ: 100/4951/4
SVQ: G7PX23

Table 1		
Reference Number	QCA Code	Title
EEE3/001	Y/101/8210	Complying with statutory regulations and organisational safety requirements
EEE3/002	L/101/7250	Using and interpreting engineering drawings and documents
EEE3/003	R/101/7251	Working efficiently and effectively in engineering
EEE3/006	R/102/9738	Providing technical guidance to others
EEE3/010	Y/102/9742	Selecting and preparing materials and components for manufacturing
EEE3/014	M/102/9746	Processing electronic components within the manufacturing system
EEE3/015	T/102/9747	Checking the compliance of electronic components against the specification
EEE3/017	F/102/9749	Assembling and wiring electronic equipment and systems
EEE3/018	T/102/9750	Testing post-production electronic components and circuits
EEE3/020	F/102/9752	Preparing facilities for testing electronic components and circuits

Electronics level 5 — Mapping

Unit Title	level	001	002	003	006	010	014	015	017	018	020
Communications	5	✓	✓	✓							
Information Technology	5	✓	✓	✓							
Mathematics/Numeracy	5		✓	✓							
Electrical Principles	5	✓	✓	✓						✓	
Fundamental Electronics	5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Electronic Test Equipment and Measurement	5	✓	✓	✓				✓		✓	✓
Soldering and Circuit Assembly Techniques	5	✓	✓	✓		✓	✓	✓	✓	✓	✓
Semiconductor Applications	5	✓	✓	✓	✓		✓			✓	✓
Combinational Logic	5	✓	✓	✓	✓		✓			✓	✓
Electronic Simulation and Testing	5	✓	✓	✓						✓	✓
Practical Electronics	5	✓	✓	✓		✓	✓	✓	✓	✓	✓
Transformation and Rectification	5	✓	✓	✓	✓					✓	✓
Safe Working Practice	5	✓	✓	✓			✓	✓	✓	✓	✓
Circuit Element Devices	5	✓	✓	✓	✓		✓	✓		✓	✓

Electronics level 6 — Mapping

Unit Title	level	001	002	003	006	010	014	015	017	018	020
Communications	6	✓	✓	✓							
Information Technology	6	✓	✓	✓							
Mathematics/Numeracy	6		✓	✓							
Electrical Principles	6	✓	✓	✓						✓	
Fundamental Electronics	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electronic Test Equipment and Measurement	6	✓	✓	✓				✓		✓	✓
Network Analysis	6	✓	✓	✓						✓	✓
Semiconductor Applications	6	✓	✓	✓	✓		✓			✓	✓
Combinational Logic	6	✓	✓	✓			✓			✓	✓
Operational Amplifiers	6	✓	✓	✓	✓		✓	✓		✓	✓
Programmable Logic Controllers	6	✓	✓	✓							
Power Supplies	6	✓	✓	✓	✓		✓			✓	✓
Programmable Systems	6	✓	✓	✓							
Electrostatics and Electromagnetics	6	✓	✓	✓							
Power Electronics	6	✓	✓	✓	✓			✓		✓	

Mapping of NQGA Electrical Units at levels 5 and 6 to:

- SEMTA Units: Electrical and Electronic Engineering level 3
- OPITO Units: Process Engineering Maintenance level 3
- Other Relevant ECITB and SUMMIT Skills units

NQGA — NC Electrical Engineering levels 5 and 6

Alignment to National Occupational Standards and Units
Table 1 indicates **SEMTA** Units used in the mapping exercise
SEMTA Units: Electrical and Electronic Engineering level 3

Table 1	
Reference Number	**Title**
EEE3/001	Complying with statutory regulations and organisational safety requirements
EEE3/002	Using and interpreting engineering drawings and documents
EEE3/003	Working efficiently and effectively in engineering
EEE3/006	Providing technical guidance to others
EEE3/026	Assembling rotor and armature windings
EEE3/027	Assembling stator windings
EEE3/028	Assembling and fitting commutators
EEE3/029	Balancing assembled rotors or armatures
EEE3/030	Assembling and fitting electrical rotating equipment
EEE3/034	Carrying out functional tests on electrical equipment
EEE3/035	Locating and diagnosing faults in electrical systems and equipment

NC Electrical Engineering level 5 — Mapping

Unit Title	level	001	002	003	006	026	027	028	029	030	034	035
Communications	5	✓	✓	✓								
Engineering: Information Technology	5	✓	✓	✓								
Mathematics: Craft 1	5		✓	✓								
Electrical Principles	5	✓	✓	✓								✓
Fundamental Electrical Systems	5	✓	✓	✓	✓							
Electrical Testing and Measurement	5	✓	✓	✓	✓						✓	✓
Electrical Wiring Skills	5	✓	✓	✓	✓						✓	
Earthing Systems	5	✓	✓	✓	✓						✓	✓
Rotating Electrical Machines	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Safe Working Practices	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NC Electrical Engineering level 6 — Mapping

Unit Title	level	001	002	003	006	026	027	028	029	030	034	035
Communications: Core Skills	6	✓	✓	✓								
Mathematics: Technician 1	6	✓	✓	✓								
Information Technology for Engineering 2	6		✓	✓								
Electrical Principles	6	✓	✓	✓								✓
Fundamental Electrical Systems	6	✓	✓	✓	✓							
Electrical Testing and Measurement	6	✓	✓	✓	✓						✓	✓
Inspection and Testing of Electrical Installations	6	✓	✓	✓	✓						✓	✓
Electrical Plant Maintenance	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Single and Three Phase Induction Motors	6	✓	✓	✓	✓							
Cable Ratings and Overcurrent Protection Devices	6	✓	✓	✓	✓							
Earthing and Earth Fault Current Protection	6	✓	✓	✓	✓							

Alignment to National Occupational Standards and Units

Table 2 indicates **SEMTA** Units used in the mapping exercise
SEMTA Units: Electrical and Electronic Engineering level 3

Table 2	
Reference Number	**Title**
045NEEE3/001	Complying with statutory regulations and organisational safety requirements
045NEEE3/002	Using and interpreting engineering drawings and documents
045NEEE3/003	Working efficiently and effectively in engineering
045NEEE3/006	Providing technical guidance to others
045NEEE3/026	Assembling rotor and armature windings
045NEEE3/027	Assembling stator windings
045NEEE3/028	Assembling and fitting commutators
045NEEE3/029	Balancing assembled rotors or armatures
045NEEE3/030	Assembling and fitting electrical rotating equipment
045NEEE3/034	Carrying out functional tests on electrical equipment
045NEEE3/035	Locating and diagnosing faults in electrical systems and equipment

NC Electrical Engineering level 5 — Mapping

Unit Title	level	001	002	003	006	026	027	028	029	030	034	035
Communications	5	✓	✓	✓								
Engineering: Information Technology	5	✓	✓	✓								
Mathematics: Craft 1	5		✓	✓								
Electrical Principles	5	✓	✓	✓								✓
Fundamental Electrical Systems	5	✓	✓	✓	✓							
Electrical Testing and Measurement	5	✓	✓	✓	✓						✓	✓
Electrical Wiring Skills	5	✓	✓	✓	✓						✓	
Earthing Systems	5	✓	✓	✓	✓						✓	✓
Rotating Electrical Machines	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Safe Working Practices	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NC Electrical Engineering: level 6 — Mapping

Unit Title	level	001	002	003	006	026	027	028	029	030	034	035
Communications: Core Skills	6	✓	✓	✓								
Mathematics: Technician 1	6	✓	✓	✓								
Information Technology for Engineering 2	6		✓	✓								
Electrical Principles	6	✓	✓	✓								✓
Fundamental Electrical Systems	6	✓	✓	✓	✓							
Electrical Testing and Measurement	6	✓	✓	✓	✓						✓	✓
Inspection and Testing of Electrical Installations	6	✓	✓	✓	✓						✓	✓
Electrical Plant Maintenance	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Single and Three Phase Induction Motors	6	✓	✓	✓	✓							
Cable Ratings and Overcurrent Protection Devices	6	✓	✓	✓	✓							
Earthing and Earth Fault Current Protection	6	✓	✓	✓	✓							

NQGA — NC Electrical Engineering levels 5 and 6

Alignment to National Occupational Standards and Units
Table 3 indicates **OPITO** units used in the mapping exercise
OPITO Units: Process Engineering Maintenance level 3

Table 3	
Reference Number	**Title**
C3.1	Hand over process engineering plant and equipment
C3.2	Reinstate the work area after completing the maintenance of process engineering plant and equipment
C3.3	Minimize risks to life, property and the environment
C3.4	Work safely, minimize risk and comply with emergency procedures
C3.5	Contribute to effective working relationships
C3.6	Prepare work areas for the maintenance of process engineering plant and equipment
E3.1	Carry out planned maintenance procedures on electrical plant and equipment
E3.2	Deal with variations and defects in electrical plant and equipment
E3.3	Diagnose and determine the causes of faults in electrical plant and equipment
E3.4	Prepare equipment in support of electrical maintenance activities
E3.5	Prepare materials for the maintenance of electrical plant and equipment
E3.6	Adjust electrical plant and equipment to meet operational requirements
E3.7	Remove components from electrical plant and equipment
E3.8	Replace components in electrical plant and equipment
E3.9	Determine the feasibility of repair of components from electrical plant and equipment
E3.10	Interpret detailed electrical information from technical sources
E3.11	Read and extract information from electrical engineering drawings and specifications
E3.12	Identify and suggest improvements to working practices and procedures on electrical plant and equipment
E3.13	Establish that and electrical engineering process has been completed to specification
E3.14	Test the performance and condition of electrical plant and equipment
E3.15	Monitor the performance and condition of electrical plant and equipment
E3.16	Assess the performance and condition of electrical plant and equipment
E3.17	Inspect electrical plant and equipment

NC Electrical Engineering level 5 — Mapping

Unit Title	level	C3.1	C3.2	C3.3	C3.4	C3.5	C3.6	E3.1	E3.2	E3.3	E3.4	E3.5	E3.6
Communications	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engineering: Information Technology	5	✓		✓		✓							
Mathematics: Craft 1	5									✓			
Electrical Principles	5									✓			
Fundamental Electrical Systems	5												
Electrical Testing and Measurement	5			✓	✓		✓			✓	✓		
Electrical Wiring Skills	5	✓	✓	✓	✓	✓	✓	✓			✓		
Earthing Systems	5	✓	✓	✓	✓						✓	✓	
Rotating Electrical Machines	5									✓			
Safe Working Practices	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Unit Title	level	E3.7	E3.8	E3.9	E3.10	E3.11	E3.12	E3.13	E3.14	E3.15	E3.16	E3.17
Communications	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engineering: Information Technology	5				✓	✓						
Mathematics: Craft 1	5			✓	✓	✓						
Electrical Principles	5			✓	✓				✓			
Fundamental Electrical Systems	5											
Electrical Testing and Measurement	5				✓	✓			✓			
Electrical Wiring Skills	5				✓	✓		✓	✓			✓
Earthing Systems	5	✓	✓	✓	✓						✓	✓
Rotating Electrical Machines	5			✓	✓	✓	✓					
Safe Working Practices	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NC Electrical Engineering level 6 — Mapping

Unit Title	level	C3.1	C3.2	C3.3	C3.4	C3.5	C3.6	E3.1	E3.2	E3.3	E3.4	E3.5	E3.6
Communications: Core Skills	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mathematics: Technician 1	6									✓			
Information Technology for Engineering 2	6	✓		✓		✓							
Electrical Principles	6									✓			
Fundamental Electrical Systems	6												
Electrical Testing and Measurement	6			✓	✓		✓			✓	✓		
Inspection and Testing of Electrical Installations	6	✓	✓	✓	✓	✓	✓	✓		✓	✓		
Electrical Plant Maintenance	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Single and Three Phase Induction Motors	6	✓	✓	✓	✓								
Cable Ratings and Overcurrent Protection Devices	6												
Earthing and Earth Fault Current Protection	6												
	level	**E3.7**	**E3.8**	**E3.9**	**E3.10**	**C3.11**	**C3.12**	**E3.13**	**E3.14**	**E3.15**	**E3.16**	**E3.17**	
Communications: Core Skills	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Mathematics: Technician 1	6				✓	✓			✓				
Information Technology for Engineering 2	6				✓	✓							
Electrical Principles	6			✓	✓				✓			✓	
Fundamental Electrical Systems	6												
Electrical Testing and Measurement	6				✓	✓			✓				
Inspection and Testing of Electrical Installations	6				✓	✓			✓			✓	
Electrical Plant Maintenance	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Single and Three Phase Induction Motors	6				✓	✓							
Cable Ratings and Overcurrent Protection Devices	6				✓	✓							
Earthing and Earth Fault Current Protection	6				✓	✓							

Alignment to National Occupational Standards and Units

Table 4 indicates **OTHER Relevant ECITB and SUMMIT Skills** Units used in the mapping exercise

Table 4			
Table Reference	**Reference Number**	**Awarding Body**	**Title**
01	ESI18	Summit Skills	Ensure safe site working (installation)
02	ESI70	Summit Skills	Provide technical and functional information to relevant people (installation)
03	ESI81	Summit Skills	Maintain a healthy and safe working environment (installation)
04	ESIBS23	Summit Skills	Install wiring systems, wiring enclosures and equipment (plant)
05	ESIBS45	Summit Skills	Inspect, test and commission an electrical installation (Installation)
06	ESSC33	Summit Skills	Carryout earthing and bonding procedures for structured cabling systems
07	ESSC35	Summit Skills	Carryout final inspection procedures for structured cabling systems
08	EMRR70D	Summit Skills	Provide technical and functional information to relevant people relating to electrical machine repair and rewind
09	EMRR81D	Summit Skills	Maintain a healthy and safe working environment when repairing or rewinding electrical machines
10	MPSE9	ECITB	Diagnose and determine the causes of faults in electrical plant and equipment
11	PLEATI6	ECITB	Inspect, test and commission an electrical installation (plant)
12	PLEATI9	ECITB	Diagnose and correct electrical faults (plant)

NC Electrical Engineering level 5 — Mapping

Unit Title	level	01	02	03	04	05	06	07	08	09	10	11	12
Communications	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Engineering: Information Technology	5	✓	✓	✓		✓			✓				
Mathematics: Craft 1	5					✓	✓				✓	✓	✓
Electrical Principles	5				✓						✓	✓	✓
Fundamental Electrical Systems	5	✓		✓									
Electrical Testing and Measurement	5	✓	✓	✓	✓	✓			✓		✓	✓	✓
Electrical Wiring Skills	5	✓	✓	✓	✓		✓	✓					✓
Earthing Systems	5	✓	✓	✓	✓	✓	✓	✓					✓
Rotating Electrical Machines	5	✓	✓	✓						✓	✓		✓
Safe Working Practices	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Electrical Plant Safety and Maintenance	5	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓

NC Electrical Engineering: level 6 — Mapping

Unit Title	level	01	02	03	04	05	06	07	08	09	10	11	12
Communications: Core Skills	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mathematics: Technician 1	6					✓	✓				✓	✓	✓
Information Technology for Engineering 2	6	✓	✓	✓		✓			✓				
Electrical Principles	6				✓						✓	✓	✓
Fundamental Electrical Systems	6	✓	✓	✓									
Electrical Testing and Measurement	6	✓	✓	✓		✓					✓	✓	✓
Inspection and Testing of Electrical Installations	6	✓	✓	✓		✓		✓	✓		✓	✓	✓
Electrical Plant Maintenance	6	✓	✓	✓		✓				✓	✓	✓	✓
Single and Three Phase Induction Motors	6		✓			✓				✓			✓
Cable Ratings and Overcurrent Protection Devices	6		✓			✓		✓					✓
Earthing and Earth Fault Current Protection	6		✓			✓	✓	✓					✓

NQGA — Manufacturing Engineering at SCQF level 5 and level 6

Alignment to National Occupational Standards (NOS)

Table 1 indicates Units used in the mapping exercise

Table 1: NOS — Mechanical Manufacturing Engineering		
Ref.	**NOS No.**	**Unit Title**
1	MME3.01	Complying with Statutory Regulations and Organisational Safety Requirements
2	MME3.02	Using and Interpreting Engineering Data and Documentation
3	MME3.03	Working Efficiently and Effectively in Engineering
4	MME3.04	Setting Centre Lathes for Production
5	MME3.05	Machining Components Using Centre Lathes
6	MME3.08	Setting Milling Machines for Production
7	MME3.09	Machining Components Using Milling Machines
8	MME3.30	Loading and Proving NC/CNC Machine Tool Programs
9	MME3.31	Carrying Out CNC Machine Tool Programming
10	MME3.32	Setting NC/CNC Turning Machines for Production
11	MME3.33	Machining Components Using NC/CNC Turning Machines
12	MME3.34	Setting NC/CNC Milling Machines for Production
13	MME3.35	Machining Components Using NC/CNC Milling Machines
14	MME3.50	Setting NC/CNC Machining Centres for Production
15	MME3.51	Machining Components Using NC/CNC Machining Centres
16	MME3.60	Producing Components Using Hand Fitting Techniques
17	MME3.61	Assembling Mechanical Products
18	MME3.72	Repairing and Modifying Mechanical Assemblies
19	MME3.73	Checking Completed Assemblies Comply with Specification

NQGA Manufacturing Engineering (SCQF level 6)																				
National Occupational Standards																				
Unit Title	C/ RC	level	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Mathematics	C	6		X							X										
Information Tech.	C	6	X	X						X	X	X	X	X	X	X	X				
Communications	C	6	X	X	X																
Engineering Assembly Skills	RC	6	X	X	X													X	X	X	X
Engineering Dimensional Control	RC	6		X	X		X		X				X		X		X	X			
Engineering Manufacturing Processes	RC	6		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Engineering Workshop Skills	RC	6	X	X	X													X	X		
Industrial CNC Machining	RC	6	X	X	X					X		X	X	X	X	X	X				
Engineering Material Removal Principles	RC	6		X		X	X	X	X			X	X	X	X	X	X				
Material Removal Practice: Turning	RC	6	X	X	X	X	X														
Material Removal Practice: Milling	RC	6	X	X	X			X	X												

NQGA Manufacturing Engineering (SCQF level 5)																				
Mathematics	C	5		X						X										
Information Tech.	C	5	X	X					X	X	X	X	X	X	X	X				
Communications	C	5	X	X	X															
Engineering Assembly Skills	RC	5	X	X	X												X	X	X	X
Engineering Dimensional Control	RC	5		X	X		X		X				X		X		X	X			
Engineering Manufacturing Processes	RC	5		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Engineering Workshop Skills	RC	5	X	X	X													X	X		
Industrial CNC Machining	RC	5	X	X	X					X		X	X	X	X	X	X				
Engineering Material Removal Principles	RC	5		X		X	X	X	X			X	X	X	X	X	X				
Material Removal Practice: Turning	RC	5	X	X	X	X	X														
Material Removal Practice: Milling	RC	5	X	X	X			X	X												

Appendix 3: Sample Timetables for NC in Engineering awards

National Certificate in Fabrication and Welding Engineering at SCQF level 5 (Full-Time)

1st Semester

Fabrication Skills F5FG 11	Fabrication Processes F5EW 11	Mathem-atics Craft 1 F3HV 11	Commi-nication Core Skills F3GB 11	Welding Processes F5F3 11	Thermal Joining Skills F5F2 11	Health & Safety: Engineering F5DG 11	Pattern Developme nt F5EX 11	Engineering Materials F5W9 11	MMA Welding Skills F5F6 11

2nd Semester

Fabrication Skills F5FG 11	Graphical Engineer-ing Commun-ication F5FP 11	Mathem-atics Craft 1 F3HV 11	Commi-nication Core Skills F3GB 11	Engineering: Using IT F5D6 11	CAD for Engineers F5H4 11	TIG Welding Skills F5FC 11	Weld. Procedure Specificat-ion & Testing F5F4 11	MIG/MAG Welding Skills F5F7 12	Engineering Project F5DE 11

National Certificate in Mechanical Maintenance Engineering at SCQF level 5 (Part-Time)

1st Year

1st Semester

Mechanical Engineering Principles F5K1 11	Mathematics: Craft 1 F3HV 11	Communication Core Skill Unit F3GB 11	Plant Maintenance Practice F5J3 11

2nd Semester

Graphical Engineering Communication F5FP 11	Mathematics: Craft 1 F3HV 11	Communication Core Skill Unit F3GB 11	Maintenance Safety F5J4 11

National Certificate in Mechanical Maintenance Engineering at SCQF level 5 (Part-Time) (cont)

2nd Year

1st Semester

Engineering: Using Information Technology F5D6 11	Engineering Materials F5WP 11	Plant Installation F5J2 11

2nd Semester

Pneumatics and Hydraulics F5K2 11	Power Drives F5K3 11	Electrical Plant Safety and Maintenance F5HH 11

National Certificate in Electrical Engineering at SCQF level 6 (Full-Time)

1st Semester

Electrical Principles F5HL 12	Circuit Element Principles F5H8 12	Math-ematics: Technician 1 F3HX 12	Fundamen-tal Electrical Systems F5D8 12	Electrical Testing & Measure-ment F5HN 12	Electrical Plant Maint-enance F5HG 12	Earthing & Earth Fault Current Protection F5HD 12	Electrical Wiring Skills F5HP 11	Communi-cation Core Skill Unit F3GB 12

2nd Semester

Single Phase & Three Phase Principles F5JV 12	Electro-statics & Electro-Magnetic F5D3 12	Math-ematics Technician 2 F3HY 12	Electrical Power Systems F5HJ 12	Switchgear & High Voltage Protection F5JX 12	Trans-formers F5K0 12	Single & Three Phase Induction Motors F5JT 12	Applica-tion of Program-mable Logic Controllers F5H0 12	Engineer-ing: Applying Information Technology F5D4 12

National Certificate in Mechanical Engineering at SCQF level 6 (Part-Time)

1st Year

1st Semester

Statics F5K8 12	Engineering Dynamics: An Introduction F5K6 12	Mathematics: Technician 1 F3HX 12

2nd Semester

Strength of Materials F5K9 12	Engineering Dynamics F5K7 12	Communication Core Skill Unit F3GB 12

National Certificate in Mechanical Engineering at SCQF level 6 (Part-Time) (cont)

2nd Year

1st Semester

Engineering: Applying Information Technology F5D4 12	Thermofluids F5JE 12	Graphical Engineering Communication F5JG 12

2nd Semester

Pneumatics and Hydraulics F5JB 12	Engineering Design F5K5 12	Computer Aided Draughting (CAD) for Engineers F5H5 12

Appendix 4: Assessment and Teaching and Learning Materials available to support the NC in Engineering awards

Assessment support packs

Mandatory Units

Product code	Product title	Will be available on SQA secure website
F3GB 11	Communication Core Skill Unit	✓
F3HV 11	Mathematics: Craft 1	✓
F5D6 11	Engineering: Using Information Technology	✓

Product code	Product title	Will be available on SQA secure website
F3GB 12	Communication Core Skill Unit	✓
F3HX 12	Mathematics: Technician 1	✓
F5D4 12	Engineering: Applying Information Technology	✓

Restricted Core: National Certificate in Electrical Engineering at SCQF level 5

Product code	Product title	Will be available on SQA secure website
F5HK 11	Electrical Principles	✓
F5D7 11	Fundamental Electrical Systems	✓
F5HM 11	Electrical Testing and Measurement	✓
F5HP 11	Electrical Wiring Skills	✓
F5HE 11	Earthing Systems	✓
F5JK 11	Rotating Electrical Machines	✓
F5JL 11	Safe Working Practices	✓
F5HH 11	Electrical Plant Safety and Maintenance	✓

Check SQA's secure website for current availability

Assessment support packs (cont)

Restricted Core: National Certificate in Electronic Engineering at SCQF level 5

Product code	Product title	Will be available on SQA secure website
F5HK 11	Electrical Principles	✓
F5DH 11	Fundamental Electronics	✓
F5DC 11	Electronic Test Equipment and Measurement	✓
F5JW 11	Soldering and Circuit Assembly Techniques	✓
F5JN 11	Semiconductor Applications	✓
F5HA 11	Combinational Logic	✓
F5HS 11	Electronic Simulation and Testing	✓
F5JJ 11	Practical Electronics	✓

Restricted Core: National Certificate in Fabrication and Welding Engineering at SCQF level 5

Product code	Product title	Will be available on SQA secure website
F5EW 11	Fabrication Processes	✓
F5F3 11	Welding Processes	✓
F5DG 11	Health and Safety: Engineering	✓
F5W9 11	Engineering Materials	✓
F5DE 11	Engineering Project	✓
F5F7 12	Metal Inert Gas (MIG) Metal Active Gas (MAG) Welding Skills	✓
F5EX 11	Pattern Development	✓
F5F1 11	Thermal Cutting Skills	✓

Restricted Core: National Certificate in Mechanical Maintenance Engineering at SCQF level 5

Product code	Product title	Will be available on SQA secure website
F5K1 11	Mechanical Engineering Principles	✓
F5HH 11	Electrical Plant Safety and Maintenance	✓
F5J4 11	Maintenance Safety	✓
F5J2 11	Plant Installation	✓
F5J3 11	Plant Maintenance Practice	✓
F5K2 11	Pneumatics and Hydraulics	✓
F5K3 11	Power Drives	✓
F5FP 11	Graphical Engineering Communication	✓

Assessment support packs (cont)

Restricted Core: National Certificate in Manufacturing Engineering at SCQF level 5

Product code	Product title	Will be available on SQA secure website
F5H4 11	Computer Aided Draughting (CAD) for Engineers	✓
F5W7 11	Engineering Dimensional Control	✓
F5W9 11	Engineering Materials	✓
F5WD 11	Engineering Material Removal Principles	✓
F5W8 11	Engineering Manufacturing Processes	✓
F5WA 11	Engineering Workshop Skills	✓
F5D9 11	Industrial CNC Machining	✓
F5FP 11	Graphical Engineering Communication	✓

Restricted Core: National Certificate in Aeronautical Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5GM 12	Aeronautical Engineering Fundamentals	✓
F5GR 12	Aircraft Systems	✓
F5GV 12	Aircraft Flight Controls	✓
F5GW 12	Aircraft Hydraulic and Pneumatic Systems	✓
F5GP 11	Aircraft Maintenance	✓
F5GX 12	Aircraft Power Plant	✓
F5H2 11	Aviation Practice	✓
F5GS 12	Avionics: An Introduction	✓

Assessment support packs (cont)

Restricted Core: National Certificate in Electrical Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5HL 12	Electrical Principles	✓
F5D8 12	Fundamental Electrical Systems	✓
F5HN 12	Electrical Testing and Measurement	✓
F5FT 12	Inspection and Testing of Electrical Installations	✓
F5HG 12	Electrical Plant Maintenance	✓
F5JT 12	Single and Three Phase Induction Motors	✓
F5H3 12	Cable Ratings and Overcurrent Protection Devices	✓
F5HD 12	Earthing and Earth Fault Current Protection	✓

Restricted Core: National Certificate in Electronic Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5HL 12	Electrical Principles	✓
F5DB 12	Fundamental Electronics	✓
F5DJ 12	Electronic Test Equipment and Measurement	✓
F5J6 12	Operational Amplifiers	✓
F5J7 12	Electronic Network Analysis	✓
F5JP 12	Semiconductor Applications	✓
F5H9 12	Combinational Logic	✓
F5J5 12	Power Supplies	✓

Assessment support packs (cont)

Restricted Core: National Certificate in Fabrication and Welding Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5F5 12	Fabrication Processes	✓
F5FD 12	Welding Processes	✓
F5KD 12	Engineering Materials	✓
F5D5 12	Engineering Project	✓
F5JG 12	Graphical Engineering Communication	✓
F5F8 12	Pattern Development	✓
F5FB 12	Thermal Cutting Processes	✓
F5FE 12	Weld Procedure Specification and Testing	✓

Restricted Core: National Certificate in Manufacturing Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5H5 12	Computer Aided Draughting (CAD) for Engineers	✓
F5KB 12	Engineering Dimensional Control	✓
F5KC 12	Engineering Manufacturing Processes	✓
F5KD 12	Engineering Materials	✓
F5KE 12	Engineering Workshop Skills	✓
F5HT 12	Industrial CNC Machining	✓
F5KH 12	Engineering Material Removal Principles	✓
F5JG 12	Graphical Engineering Communication	✓

Assessment support packs (cont)

Restricted Core: National Certificate in Measurement and Control Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5KR 12	Engineering: Measurement Technology — Flow	✓
F5KT 12	Engineering: Measurement Technology — Pressure/level	✓
F5KS 12	Engineering: Measurement Technology — Temperature	✓
F5KK 12	Engineering: Process Control	✓
F5KW 12	Engineering: Process Control Systems	✓
F5KM 12	Engineering: Distributed Control Systems	✓
F5H0 12	Applications of Programmable Logic Controllers	✓
F5KX 12	Engineering: Signal Conditioning in Telemetry	✓

Restricted Core: National Certificate in Mechanical Engineering at SCQF level 6

Product code	Product title	Will be available on SQA secure website
F5K8 12	Statics	✓
F5K6 12	Engineering Dynamics: An Introduction	✓
F5JE 12	Thermofluids	✓
F5K9 12	Strength of Materials	✓
F5K7 12	Engineering Dynamics	✓
F5JF 12	Engineering Thermodynamics	✓
F5JB 12	Pneumatics and Hydraulics	✓
F5JC 12	Power Drives	

e-Assessment Materials

Product code	Product title	Will be available on SQA secure website
F5HK 11	Electrical Principles (SCQF level 5)	✓
F5HL 12	Electrical Principles (SCQF level 6)	✓
F5DG 11	Health and Safety: Engineering	✓
F5JL 11	Safe Working Practices	✓

Learning and Teaching Materials

Product code	Product title	Will be available on SQA secure website
F5HK 11	Electrical Principles (SCQF level 5)	✓
F5HL 12	Electrical Principles (SCQF level 6)	✓
F5D7 11	Fundamental Electrical Systems	✓
F5JL 11	Safe Working Practices	✓