

Arrangements Document

HNC Fabrication, Welding & Inspection

Group Award Code: G837 15

**A Higher National Development under the new
SQA HN Design Principles**

Validated June 2005

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HNC FABRICATION, WELDING & INSPECTION
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1 Rationale for the Qualification

1.1 Introduction

This award has been developed under the new SQA Design Principles and replaces HNC Engineering: Fabrication, Welding & NDT.

This document details the background to the development of the new award, the aims (both general and specific), recommended access requirements, information about the structure of the award and recommendations on delivery and assessment.

It has been written to assist centres in preparing for approval for the new HNC award and maintaining the award thereafter.

1.2 HN Engineering Frameworks

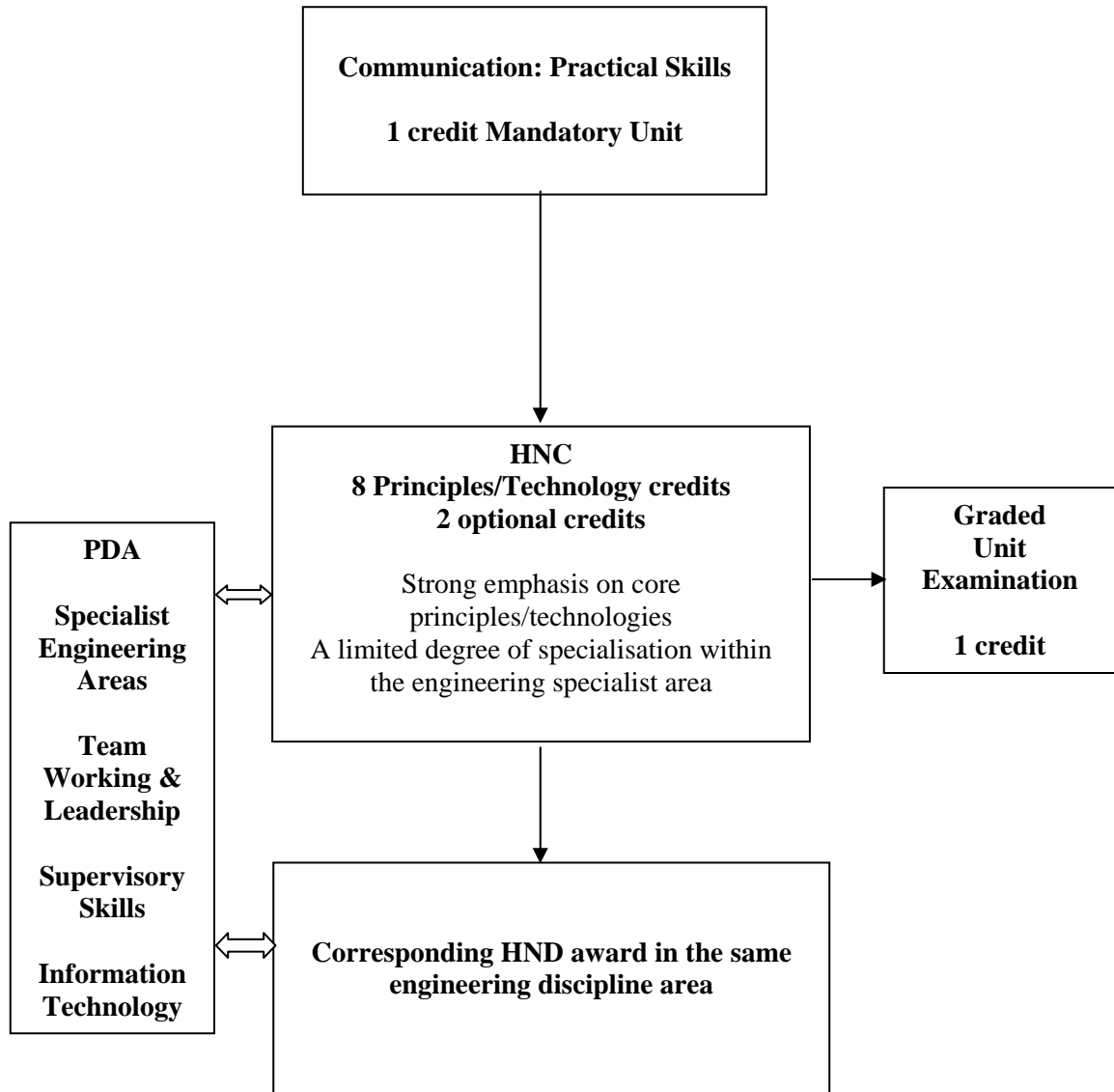
In 1996 the SQA nationally validated a large number of new HN Engineering awards including two awards entitled HNC and HND Fabrication, Welding & NDT. A major difference between these and previous awards was that they all sat within an HN Engineering framework which in general terms consisted of a common core of Units, a principles and technology section and an optional section. The benefits of this framework structure were seen to include the following:

- ◆ provide a wide range of HN Engineering qualifications to meet the needs of different engineering sectors
- ◆ improve the credibility and esteem of individual HN Engineering awards
- ◆ clarify the competencies that were common to all incorporated engineers and those that were specific to particular engineering disciplines
- ◆ provide opportunities for the efficient delivery of HN Engineering Units by, for example, incorporating Units that were common to a number of engineering disciplines
- ◆ facilitate better progression between HNC, HND and degree engineering awards

1.3 Consultation

Before proceeding with the development of the award it was necessary to consult with stakeholders to check if the overarching HN Engineering Framework was still valid. The revised HNC Framework is shown below. It should be noted that the PDAs shown in the diagram may be developed as more HN Units come on stream, currently these are only given as examples.

HNC ENGINEERING FRAMEWORK



Consultation on the Fabrication, Welding and Inspection Framework consisted of the following:

- ◆ a questionnaire survey of stakeholders of HN Engineering awards
- ◆ a series of meetings with interested stakeholders of the awards
- ◆ major consultation events with FE colleges during November 2003 and January 2004 which included a questionnaire survey

This consultation revealed strong support for an overarching HN Engineering Framework but with the following modifications:

- ◆ a reduction in the number of common Core Units
- ◆ a strengthening of the Principles and Technology section with an even stronger emphasis on the teaching of core engineering principles and technologies
- ◆ retention of optional sections to meet local industrial demands

This exercise was augmented by analysing the SQA data on award uptake and achievement and Unit uptake over the last five sessions. This showed the following:

- ◆ HNC average of 135 candidates per year
- ◆ HNC success rate of over 71% per year
- ◆ HND average of five candidates per year
- ◆ HND success rate of 50% per year

The Principles and Technology Units had a high uptake as they were mandatory. Of the optional Units, Shipbuilding, Pipework and NDT Units had low uptakes. Flexible Units such as CAD, which went across other Engineering frameworks, had a proportionately high uptake.

The development team submitted two alternative frameworks to the stakeholder meetings. The frameworks did not contain Principles and Technology Units in Shipbuilding and Pipework. However a strong desire was expressed to retain these Units as limited options within the framework and this was implemented. It was also decided that the preferred framework would contain five core Principle and Technology Units and four sections of two limited option Principle and Technology Units. The candidates are required to select one pair and any one other Unit from the Limited Option sections. The other major decision taken at this time was that the Graded Unit should take the form of an examination.

At this stage it was agreed to drop the award of HND Engineering: Fabrication, Welding & NDT due to the low uptake by centres.

1.4 Market Research

The development of the new award included extensive market research as follows:

- ◆ major desk-based research gathering and analysing data from various sources (SEMTA, Future Skills Scotland etc)
- ◆ initial postal survey of all delivery centres followed by two national seminars (draft Units were made available to centres on CD). Surveys of employers/centres on framework and Units were carried out
- ◆ the framework and Units were given to The Welding Institute for comment and support with regard to prospective membership
- ◆ the framework was circulated to the HN Engineering Sector Panel which is made up of representatives from employers, SEMTA, FE, HE, Scottish Enterprise and Scottish Engineering

This consultation confirmed that this award should be consistent with other Engineering frameworks ie Communications Unit, eight Principles and Technology Units, two optional Units and a Graded Unit.

1.5 Candidates

Candidates at HNC level may already be in employment and will attend centres on a day release or other part-time basis. The HNC framework structure is flexible enough to allow centres to deliver the HNC award by various modes of delivery for example, two-year day-release, evening attendance etc.

The options chosen by employed candidates may reflect the branch of industry in which they are employed or may be used to gain knowledge of other areas within fabrication and welding engineering in order to improve their career opportunities in the employment market. Part-time candidates may also use the HNC award to gain entry to HND level studies.

Full-time HNC candidates may be candidates who wish to progress from an appropriate National Certificate qualification. Full-time candidates may also be more mature persons who are seeking a change of employment.

Since the HNC award can form an integral part of an HND award, it would be advisable for full-time candidates to complete 15 Unit credits in the course year, 12 of these meeting the HNC requirements. Full-time candidates will therefore have completed the first year of an HND programme and may, if they wish, continue to the second year of the HND award. The 'extra' Units chosen should reflect the requirements of the selected HND award.

Successful candidates will have enhanced their prospects of gaining employment in the Fabrication and Welding industry.

2 Aims of the Award

The general and specific aims of the HNC Fabrication, Welding & Inspection are provided below.

2.1 General Aims

The general aims of this award are to:

- 2.1.1 enhance candidates' employment prospects
- 2.1.2 support candidates' Continuing Professional Development and career development
- 2.1.3 enable progression within the SCQF (Scottish Credit and Qualifications Framework)
- 2.1.4 develop candidates' ability to apply analysis and synthesis skills to the solution of fabrication, welding and inspection problems
- 2.1.5 develop learning and transferable skills including Core Skills where appropriate

2.2 Specific Aims

The specific aims of this award are to:

- 2.2.1 provide an award that will allow candidates to work now, or in the future, as technicians or incorporated engineers in the fabrication industry
- 2.2.2 provide an award that creates a route towards meeting the academic requirements for Incorporated Engineer status
- 2.2.3 develop an award that on successful completion will allow candidates to progress to an HND Engineering award
- 2.2.4 develop a range of communication skills relevant to the needs of incorporated engineers
- 2.2.5 develop knowledge, understanding and skills in a range of core fabrication, welding, quality, materials and inspection systems principles and technologies at Higher National level
- 2.2.6 allow a degree of specialisation within the following areas: Fabrication; Welding; Shipbuilding and/or Pipework Engineering
- 2.2.7 on successful completion of the award achieve the Core Skill in Communication at Higher Level and be provided with opportunities to develop the following Core Skills: Information Technology; Numeracy and Problem Solving

The grid below shows where the Unit specifications match the aims of the award:

Unit	Objectives
Communication: Practical Skills	2.2.4; 2.2.7
Welding Principles and Applications 1	2.1.1; 2.1.4; 2.2.5; 2.2.6
Fabrication: Preparation, Joining and Assembly	2.1.1; 2.1.4; 2.2.5; 2.2.6
Quality Management: An Introduction	2.1.2; 2.1.3; 2.1.5
Fabrication & Welding Materials	2.1.4; 2.2.1; 2.2.5; 2.2.6
Inspection Systems	2.1.4; 2.2.1; 2.2.5; 2.2.6
Welding Principles and Applications 2	2.1.1; 2.1.4; 2.2.5; 2.2.6
Welding Procedures: Specification, Qualification and Testing	2.1.1; 2.1.4; 2.2.5; 2.2.6
Fabrication Forming Processes	2.1.1; 2.1.4; 2.2.5; 2.2.6
Containers: Design and Manufacture	2.1.1; 2.1.4; 2.2.5; 2.2.6
Pipework 1: Construction and Site Installation	2.1.1; 2.1.4; 2.2.5; 2.2.6
Pipework 2: Pipe Bending and Pipe System Design	2.1.1; 2.1.4; 2.2.5; 2.2.6
Shipbuilding Principles: Planning, Production and Assembly	2.1.1; 2.1.4; 2.2.5; 2.2.6
Shipbuilding Principles: Advanced Hull and Associated Technologies	2.1.1; 2.1.4; 2.2.5; 2.2.6
Information Technology: Applications Software 1	2.1.5; 2.2.7
Computer Aided Draughting for Engineers	2.1.2; 2.2.7
Engineering Project	2.1.2; 2.1.4; 2.1.5; 2.2.1; 2.2.2
Mathematics for Engineering 1	2.2.3; 2.2.7
Design Analysis: Fabrication & Welding	2.1.4; 2.2.1; 2.2.2; 2.2.7
Performing Magnetic Particle Inspection	2.1.1; 2.1.4; 2.2.5; 2.2.6
Performing Liquid Penetrant Inspection	2.1.1; 2.1.4; 2.2.5; 2.2.6
Safety Engineering and the Environment	2.2.1
Destructive Testing	2.2.5; 2.2.6
Engineering Drawing	2.2.1
Materials Selection	2.1.4; 2.2.3
Engineering Principles	2.1.4; 2.2.3
Economics of Manufacture	2.1.4; 2.2.3
Process and Equipment Selection	2.1.4; 2.2.3
Engineering Measurement	2.1.4; 2.2.3
Fabrication, Welding & Inspection: Graded Unit	2.1.2; 2.1.3; 2.1.4; 2.1.5; 2.2.1; 2.2.2; 2.2.3; 2.2.5; 2.2.6

3 Access to the Award

3.1 Access requirements for the award

It is intended that admission to the award should be as broadly based as possible. The following are offered as guidelines only:

- ◆ National Certificate Group Award in Fabrication and Welding Engineering
- ◆ National Certificate Group Award in Fabrication and Welding Engineering Practice
- ◆ National Certificate Group Award in Engineering or Engineering Practice with the addition of fabrication and welding Units
- ◆ A choice of two Highers from Fabrication and Welding Engineering, Technological Studies, Graphic Communication, Craft and Design or Physics
- ◆ At the discretion of the centre for applicants with a different experiential background who could benefit from taking the course or individual Units within the course, eg adult returners, overseas students
- ◆ Advanced Certificate in Fabrication and Welding Engineering Practice
- ◆ Qualifications comparable to the above gained through other awarding bodies such as GCSE, City and Guilds etc

3.2 Alternative access arrangements

The centre may operate alternative access arrangements in cases where the candidate is convinced that they already have the required competencies in a given area. These arrangements are as follows:

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

Individual centres must outline their systems for each of these as part of any approval procedure.

4 Structure of the Award

4.1 HNC Fabrication, Welding & Inspection (G837 15) (12 Credits)

Mandatory Units (6 credits)

Unit Title	Unit Code	SCQF level	Credit Value
Communication: Practical Skills	D77G 34	level 7	1
Principles and Technology Core:			
Welding: Principles and Applications 1	DR2G 34	level 7	1
Fabrication: Preparation, Joining and Assembly	DR2C 34	level 7	1
Quality Management: An Introduction *	DT8Y 34	level 7	1
Fabrication & Welding Materials	DR2H 34	level 7	1
Inspection Systems	DR26 34	level 7	1

Principles and Technology Limited Options (2 credits from one of the following groups plus 1 additional credit from one of the remaining groups)

Welding: Principles and Applications 2	DR1Y 34	level 7	1
Welding Procedures: Specification, Qualification and Testing	DR24 34	level 7	1

OR

Fabrication Forming Processes	DR25 34	level 7	1
Containers: Design and Manufacture	DR23 34	level 7	1

OR

Pipework 1: Construction and Site Installation	DR29 34	level 7	1
Pipework 2: Pipe Bending and Pipe System Design	DR2A 34	level 7	1

OR

Shipbuilding Principles: Planning, Production and Assembly	DR2F 34	level 7	1
Shipbuilding Principles: Advanced Hull and Associated Technologies	DR2E 34	level 7	1

Optional Units (2 credits) [these 2 credits may alternatively come from one of the above 4 Principles and Technology Limited Options groups]

Unit Title	Unit Code	SCQF level	Credit Value
Information Technology: Applications Software 1*	D75X 34	level 7	1
Computer Aided Draughting for Engineers*	DR1X 34	level 7	1
Engineering Project	DR20 34	level 7	1
Mathematics for Engineering 1: Mechanical and Manufacturing*	DT5X 33	level 6	1
Design Analysis: Fabrication and Welding	DR22 34	level 7	1
Performing Magnetic Particle Inspection	DR28 33	level 6	1
Performing Liquid Penetrant Inspection	DR27 33	level 6	1

Unit Title	Unit Code	SCQF level	Credit Value
Safety Engineering and the Environment	DR2D 34	level 7	1
Destructive Testing	DR21 34	level 7	1
Engineering Drawing*	DR1W 34	level 7	1
Materials Selection*	DT46 34	level 7	1
Engineering Principles*	DR3L 34	level 7	1
Economics of Manufacture *	DT5R 34	level 7	1
Process and Equipment Selection *	DT62 35	level 8	2
Engineering Measurement *	DT9R 34	level 7	1
Personal Development Planning	DE3R 34	level 7	1
Workplace Communication in English	DE1K 34	level 6	1

* These Units also form part of both the HNC/HND Manufacturing Engineering and HNC/HND Mechanical Engineering awards.

Mandatory Graded Unit

Fabrication, Welding & Inspection: Graded Unit (Examination of 3 Hours)	DR37 34	level 7	1
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4.2 Graded Unit

The purpose of the Graded Unit is to assess the candidate's ability to integrate and apply the knowledge and/or skills gained in individual Units, to demonstrate that they have achieved the specific aims as detailed in section 2.2 and to grade candidate achievement.

4.3 Conditions of the Award

Candidates will be awarded the HNC Fabrication, Welding & Inspection on successful completion of 11 Unit credits plus one Graded Unit based on the award structure shown in section 4.1. More specifically this award structure requires that candidates achieve the following:

- ◆ the 1 Unit credit Communication: Practical Skills
- ◆ 8 Unit credits from the Principles and Technology section
- ◆ 2 Unit credits from the Optional section
- ◆ Fabrication, Welding & Inspection: Graded Unit

4.4 Core Skills in the Award

4.4.1 Exit profile

A candidate who successfully achieves an HNC Fabrication, Welding & Inspection will potentially obtain the following Core Skills Exit Profile:

- ◆ Communication Higher (fully embedded in the Unit Communication: Practical Skills)
- ◆ Problem Solving Intermediate 2
- ◆ Information Technology Intermediate 1
- ◆ Numeracy Intermediate 1
- ◆ Working with Others Intermediate 2

The above exit profile is dependent on the Units selected.

4.4.2 Entry Profile

Given the information on Core Skills provided in the previous section the following minimum Entry Profile is recommended:

- ◆ Communication Intermediate 2
- ◆ Problem Solving Intermediate 1
- ◆ Information Technology Access 2
- ◆ Numeracy Access 2
- ◆ Working with Others Intermediate 1

4.4.3 Core Skills Map

A map signposting Units against Core Skills is included in Appendix 3.

5 Approaches to Delivery and Assessment

5.1 Content and Context

Throughout the design and development of the award the development team placed a high priority on producing an award that allows candidates to develop appropriate technical and practical skills. It is not possible to quantify these skills in exact detail. However the development team took the view that the best way to prepare candidates to meet the changing requirement of modern industry is to ensure that they have a solid foundation of theory and practice upon which they can build new knowledge, understanding and skills. Thus, the Principles and Technology section of the award has mandatory Units in Fabrication, Welding, Quality, Materials and Inspection Systems. The optional sections of the Principles and Technology section allow candidates to select the group(s) of Units which best reflect their industrial and career aspirations. This group contains specialist Units in Welding, Fabrication, Shipbuilding and Pipework Engineering.

The optional section of the award provides candidates with the opportunity to specialise in technical and/or non-technical subjects. In line with normal good practice centres are encouraged to advise candidates to select those options which will meet their future needs both for career and educational progression.

5.2 Delivery and Assessment

5.2.1 Delivery

The new HNC award can be delivered by the following means:

- ◆ Full-time
- ◆ Part-time day
- ◆ Part-time evening
- ◆ Block-release
- ◆ Flexible learning
- ◆ Open Learning

The suggested method of delivery would be classroom lectures followed by laboratory/practical work to reinforce the classroom delivery. Candidates could also be set research tasks to complement this.

In timetabling the award centre staff should take account of the information contained in the Recommended Prior Skills and Knowledge statements in Unit specifications. Industrial visits are encouraged to provide candidates with 'real life' examples of the application of theory and practice learnt in the classroom.

One of the key reasons the HN Development Team has sought to reduce the time candidates have to spend on summative Unit assessment is to provide lecturers with more time to deliver Units. Lecturers are encouraged, in particular, to use this additional time to reinforce learning in core principles and technologies and enhance the development of candidates' practical skills.

Lecturers may use a variety of teaching and learning approaches in delivering the Units in the award. These may include lecturing, group work, laboratory and practical work, computer simulation (using appropriate software packages), 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.

An exemplar timetable for a day-release course is included in Appendix 1

Lecturers should also seek opportunities to integrate Core Skills within their teaching and learning programmes. Such opportunities may include the following:

Communication

- ◆ Providing candidates opportunities to develop their oral skills by allowing them to give full answers to questions asked by the lecturer.
- ◆ Develop complex, vocationally specific reading skills (eg Quality Management: An Introduction etc.)
- ◆ Develop report writing skills in a number of Units (eg Fabrication and Welding Materials etc)
- ◆ Allowing candidates to develop their Communication skills in group work activities (eg Communication: Practical Skills etc)

Numeracy

- ◆ Reinforcing Numeracy and Mathematical skills when teaching engineering topics (eg Design Analysis: Fabrication and Welding, Containers: Design and Manufacture etc)
- ◆ Reinforcing Using Graphical Information skills by use of a range of graphical representations (eg Fabrication and Welding Materials, Fabrication Forming Processes etc)

Information Technology

- ◆ Developing Information Technology skills through the application of IT within an Engineering context (eg Computer Aided Draughting for Engineers etc)

Problem Solving Skills

- ◆ Developing Critical Thinking Skills through the application of engineering principles and technologies to solve engineering problems
- ◆ Developing Planning and Organisational skills (eg Fabrication: Preparation, Joining and Assembly etc)
- ◆ Developing reviewing and evaluation skills through, for example, the review and evaluation of the Outcomes of assignments and project work (eg Quality Management: An Introduction, Inspection Systems etc)

Working with Others

- ◆ Developing Working with Others skills through group discussion on the solution to engineering problems (eg Containers: Design and Manufacture, Engineering Project etc)

5.2.2 Assessment

The assessment strategy of the new design principles encourages a more holistic approach to assessment and has been adopted in the award. The new HN Unit specification places the emphasis on reducing assessment load for candidates and centres by devising assessments that assess the entire content where appropriate and by sampling knowledge and/or skills carried out under closed book conditions on a random basis to ensure that candidates do not have prior knowledge of the sample.

Unit specifications detail exactly the Evidence Requirements and assessment procedure for each assessment event. Should centres wish to use a different mode of assessment from that recommended they should seek prior moderation from SQA.

Exemplar assessment material for all the mandatory Principles and Technology Units and many of the optional Principles and Technology Units are available for centre reference.

From the outset of developments the HN Development Team recognised the need to have an appropriate assessment strategy in place for the HNC Fabrication, Welding and Inspection award. Such a strategy was developed and is shown below:

Aims

To ensure that:

- (1) consistent, rigorous and efficient approaches are adopted to the development and administration of assessment instruments at both Unit and Graded Unit levels, which will 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 assessments.

Objectives

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

- (1) Develop nationally at least one assessment exemplar pack for each mandatory Unit, which clearly sets out the standards of assessment expected in the Unit.
- (2) Adopt a holistic approach to Unit assessment. The implications of this are as follows:
 - (i) Assessment instruments will normally be designed only to sample knowledge and skills in a Unit (this is consistent with the new HN Unit format)
 - (ii) A Unit assessment strategy will be adopted, where possible, to produce a single assessment instrument for the whole Unit. Where this is not possible the assessment strategy will seek to ensure that the minimum number of assessment instruments required are consistent with maintaining agreed national standards.
- (3) Whilst not seeking to be entirely prescriptive with regard to the time spent on assessment in each HN Unit, over assessment should be avoided. Assessment times are clearly stated in the individual Unit Specifications.
- (4) Produce assessment exemplar packs for the Graded Unit. For the Graded Unit examination produce at least one sample exam paper to show the standards expected in such a paper.
- (5) Actively encourage centres to work in partnership in producing Graded Unit assessment materials, which meet nationally agreed standards reducing, in turn, the workload on staff in individual colleges.
- (6) Ensure that consistent and rigorous internal and external moderation procedures operate through both HN Unit level and Integrative 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 exemplars and Graded Unit materials.

5.2.3 Re-assessment

The way in which centres re-assess candidates is integral to the way they manage the award assessment process as a whole. Re-assessment should be subject to rigorous internal moderation in exactly the same way as assessment is.

Candidates may require to be reassessed on only a part of an assessment where their evidence has been generated over a period of time and/or a discrete part of the Unit, such as an Outcome, has been assessed originally. On other occasions it may not be possible to reassess candidates on parts of their performance which are unsatisfactory. Situations where candidates may have to re-do a whole assessment include:

- ◆ assessments which test knowledge and understanding and where it may not be possible to extract some of the items for reassessment purposes
- ◆ where parts of several Outcomes are involved
- ◆ where a project/case study has been designed as an integral assessment and where there is a requirement to complete the project/case study as a single complex task

Re-assessment Opportunities

Reassessment should operate in accordance with a centre's assessment policy and the professional judgment of the assessor. SQA advises that there should normally be one, or in exceptional circumstances two, reassessment opportunities. Please refer to SQA's *Guide to Assessment and Quality Assurance for Colleges of Further Education, August 2003 revisions*

Developing Alternative Assessments

The design of original assessments should inform the reassessment process to a large extent, as the original determines the type of assessment instruments used and the purpose of the assessment. It is normal practice for centres to build up a bank of assessments which can be used in whole or in part for reassessment purposes.

Assessment writers should always refer to the Unit specification when developing an alternative assessment to ensure that it is of equal demand as the original assessment and that it covers all the necessary criteria. Where candidates have not provided satisfactory evidence for knowledge and/or skills items which have been sampled, they should be reassessed on a different sample.

Re-assessing HN Graded Units

Reassessment of the Fabrication, Welding and Inspection: Graded Unit 1 should be based on an alternative examination paper.

6 Guidance for Centres

6.1 Assessment Moderation

All assessment instruments used within the HNC Fabrication, Welding and Inspection award should be internally moderated, including assessment exemplar materials, using appropriate policies within the centre and guidelines provided by SQA. This will ensure the validity and reliability of the instruments of assessment used within the centre.

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

For further information on internal and external moderation refer to the *SQA Guide to Assessment and Quality Assurance for Colleges of Further Education, August 2003 revision*.

6.2 Open Learning

Advice on the use of open and distance learning is given in individual Unit specifications. However, where it is used with regard to assessment, planning would be required by the centre concerned 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 Unit end test a centre would have to make arrangements for the test 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 to undertake the assessment under the conditions specified in the Unit specification.

It should be noted that the same requirements as specified in the previous paragraph apply where part or all of a Unit is delivered on-line.

6.3 Additional Support Needs

The award has been designed to ensure that there are no artificial barriers to learning or assessment. Centres should take account of the needs of individual candidates when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For further information on these please refer to the SQA publication: *Guidance on Special Assessment Arrangement*

6.4 Credit Transfer

A Guide to Credit Transfer between old HNC Engineering: Fabrication, Welding and NDT Units and the new Units is included in Appendix 2.

This document has been designed to make it as straightforward as possible for staff to work out the level of credit transfer a candidate with 'old' HN Units or an 'old' HNC award can count towards the new HNC award.

6.5 General Information for Candidates

The new HNC in Fabrication, Welding and Inspection has been designed by an expert team of educators with considerable industrial experience with a view to allowing you to meet the educational requirements to work as a technician or supervisor in the Fabrication and Welding industry. The new qualification contains up-to-date and relevant subject content and skills and has been designed to satisfy the new SQA Higher National Design Rules.

The development team has designed the new award so that you have opportunities to learn and understand the core principles and technologies that underpin Fabrication, Welding and Inspection. Learning these will be essential in providing you with a platform for tackling many tasks and allowing you to develop a more in-depth knowledge of the industry.

As well as studying Fabrication, Welding and Inspection subjects, you will also take Communications with an option to do Information Technology as part of the HNC. Good Communication skills are essential to understanding technical material and to communicating with others whether on an individual basis or as part of a team. You will learn to develop such skills when doing the HNC.

Care should be exercised when selecting your Principles and Technology Mandatory and Limited Options. You need to decide if you are going to progress to an HND or apply to a Professional Body such as the Welding Institute for membership. If you decide on this route you should, with guidance, explore the options required by these organizations with regard to membership. You may need to incorporate Mathematics for Engineering 1 and/or Engineering Project into your options. Centre staff will be able to put you in touch with the Institute or you can contact them at www.twi.co.uk. Membership can lead to the award of Incorporated Engineer.

The development team has ensured that assessments in the award meet national standards. The award has been designed to optimise assessment so that sufficient time is available to you to learn the core principles and technologies and the practical skills that are essential for a good technician or craftsman.

You can expect to do assessment at individual Unit level and at qualification level. At Unit level this will consist of some form of written end test or a combination of written and practical tests depending on the optional Units selected. You should be informed at the start of the Unit what form assessment will take. In addition to Unit tests there will also be a 3-hour qualification examination. This assessment has been designed to allow you to demonstrate your ability to integrate knowledge, understanding and skills learnt in the award as a whole.

Centres should provide candidates with a brief summary of the Group Award before they commence their course of study. It should include information on what the award is about, provide information on the knowledge and skills to be developed, what is involved in assessment with particular reference to the Graded Unit and Core Skills and the conditions of the award. This would normally be presented in a course handbook and should also include information on the possible route(s) of progression in education, types of employment available for candidates obtaining the qualification and/or the requirements of awards from related awarding bodies eg Personnel Certification for Non-Destructive Testing; The Welding Institute.

The HNC Fabrication, Welding and Inspection Development Team does not wish to place any artificial barriers in the way of potential candidates wanting to study for the award. However, it would be unfair to enrol a candidate on the HNC who did not have a realistic chance of successfully achieving the award. The HNC Development Team would therefore recommend that a candidate had one of the following qualifications before entering the HNC:

- (1) Two Highers from Fabrication and Welding Engineering, Technological Studies, Graphic Communication, Craft and Design or Physics
- (2) National Certificate Group Award in Fabrication and Welding Engineering
- (3) National Certificate Group Award in Fabrication and Welding Engineering Practice

- (4) National Certificate Group Award in Engineering or Engineering Practice with the addition of fabrication and welding Units

6.6 Progression Pathways

Most HNCs form the first part of a corresponding HND. This is not the case with this award. As already mentioned an HND: Fabrication, Welding and Inspection will not be developed under the new design rules.

As a number of Units are common with other HNC awards it should enable candidates with an HNC Fabrication, Welding & Inspection to progress within the general structure of other HND engineering awards. Guidance should be given on the selection of optional Units to candidates who intimate that they may consider this pathway. The recommended option would be for centres to select the generic HND Engineering award.

Successful candidates should also be encouraged to consider furthering their careers by investigating membership of Professional Bodies such as The Welding Institute, Personnel Certification for Non-Destructive Testing, or development in a series of PDA awards.

6.7 Relationship to Other Awards

It is anticipated that candidates will have opportunities to transfer a number of Units between HNC Fabrication, Welding & Inspection and HNC Manufacturing Engineering and HNC Mechanical Engineering and vice versa. More limited opportunities will exist for candidates to transfer Units between HNC Electronics and HNC Electrical Engineering.

6.8 History of Change

It is anticipated that changes will occur during the life of the award eg additional optional Units, updating Unit specification etc. This section of the document will be used to record any such changes.

Date	Version Number	Author	Description of Change
24/10/06	02	Gill Alves	Removal of Graded Units — see website for Graded Units
15/11/07	03	Shirley Sampson	Addition of two Broadening Units

Appendices

Appendix 1

Exemplar Timetable

DAY RELEASE STUDENT TIMETABLE

CLASS/GROUP: H1 FABRICATION, WELDING AND INSPECTION (Year 1)

DAY	SEMESTER	09.00-10.00	10.00-11.15	11.15-12.15	12.15-13.00	13.00-14.00	14.00-15.00	15.00-16.30
		1	2	3	LUNCH	5	6	7
TBA	SEMESTER 1	Welding: Principles And Applications 1		Fabrication: Preparation, Joining and Assembly			Fabrication and Welding Materials	
TBA	SEMESTER 2	Quality Management: An Introduction		Inspection Systems			Welding Procedures: Specification, Qualification and Testing	

DAY RELEASE STUDENT TIMETABLE

CLASS/GROUP: H2 FABRICATION, WELDING AND INSPECTION (Year 2)

DAY	SEMESTER	09.00-10.00	10.00-11.15	11.15-12.15	12.15-13.00	13.00-14.00	14.00-15.00	15.00-16.30
		1	2	3	LUNCH	5	6	7
TBA	SEMESTER 1	Welding Principles and Applications 2		Containers: Design and Manufacture			Fabrication Forming Processes	
TBA	SEMESTER 2	Communication: Practical Skills		Computer Aided Draughting for Engineers			Graded Unit	

Appendix 2

Guide to Credit Transfer

Transfer Grids

HN Unit Credit Transfer Grid

HN Unit: Destructive Testing

New/Revised Unit Title	New/Revised Outcomes	Old Unit Title	Old Unit Outcomes	Matching Comments	Credit Transfer Rec/mend
Destructive Testing	<ol style="list-style-type: none"> 1 Describe the role of destructive testing methods. 2 Explain destructive testing method applications and how they are used. 3 Evaluate destructive testing methods. 	Destructive Testing	<ol style="list-style-type: none"> 1 Describe the role of destructive testing in the quality control of welded fabrications. 2 Perform destructive tests in accordance with specified standards. 3 Evaluate test results. 	The content of the new Unit has been reduced. No new material has been added.	100% credit transfer from OLD to NEW Units.

HN Unit Credit Transfer Grid

HN Unit: Design Analysis: Fabrication & Welding

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Design Analysis: Fabrication & Welding	1	Apply beam theory to the solution of design problems	Design Analysis: Fabrication & Welding	1	Apply vectors to the analysis of two dimensional frameworks	The content of the new Unit has been reduced from that of the old Unit. There is nothing contained in the new Unit that was not in the old Unit.	100% credit transfer from OLD to NEW Units.
	2	Apply vectors to the analysis of two dimensional frameworks		2	Apply beam theory to the solution of design problems		
	3	Apply strut theory to the solution of design problems		3	Apply strut theory to the solution of design problems		
	4	Design bolted and welded connections subjected to uniaxial loads		4	Design bolted and welded connections subjected to uniaxial loads		

HN Unit Credit Transfer Grid

HN Unit: Engineering Drawing

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Engineering Drawing	1	Interpret simple engineering drawings and apply modifications	Design Drawing and Communication for Engineers	1	Produce drawings of engineering components and assemblies	Outcome 1 of the new Unit does not completely match that of any of the Outcomes in the old Unit, although it is reasonable to suppose that some interpretation of drawings will be necessary to produce drawings. Some circuit symbols included. Outcome 2 of the new Unit is similar to Outcome 1 of the old Unit Outcome 3 of the new Unit is similar to Outcome 3 of the new Unit	100% credit transfer from OLD to NEW Units.
	2	Produce two-dimensional engineering drawings from which manufacture and assembly will be possible		2	Produce circuit diagrams to illustrate the use of engineering symbols		
	3	Prepare a parts list and add instructions for manufacture and assembly		3	Prepare a parts list		

HN Unit Credit Transfer Grid

HN Unit: Fabrication and Welding Materials

New/Revised Unit Title	New/Revised Outcomes	Old Unit Title	Old Unit Outcomes	Matching Comments	Credit Transfer Rec/mend
Fabrication and Welding Materials	<ol style="list-style-type: none"> 1 Recognise the metallurgical principles and changes affecting the structures of metals and its alloys. 2 Explain the factors affecting the weldability of metals and alloys. 3 Identify failure mechanisms encountered in materials used within fabrication and welding. 	Fabrication and Welding Materials: Common	<ol style="list-style-type: none"> 1 Explain the factors which affect the structure, physical and mechanical properties of common metals and alloys. 2 Explain the factors affecting the weldability of metals and alloys. 3 Explain the basic principles of failure in materials and recommended methods of reducing the risk of failure. 	The content of the new Unit has been reduced. No new material has been added.	100% credit transfer from OLD to NEW Units.

HN Unit Credit Transfer Grid

HN Unit: Pipework: Pipe Bending and System Design

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Pipework 2: Pipe Bending and System Design	1	Understanding the changes in mechanical properties when pipe bending has taken place	Pipework Principles: Pipe Bending and System Design	1	Advise on bending pipes to a given specification	The content of the new Unit has been increased from that of the old Unit.	50% credit transfer from OLD to NEW Units.
	2	Understand the main features of pipe system design		2	Specify the main design features of pipe systems.		
	3	Be conversant with safety procedures on pipe, vessel repair.		3	Advise on safety precautions when installing and repairing pipework.		
	4	Be conversant with pipe system inspection		4			

HN Unit Credit Transfer Grid

HN Unit: Pipework: Construction and Site Installation.

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Pipework 1 Construction and Site Installation.	1	Pressure vessel, heat exchanger and storage vessel construction.	Pipework Principles: construction and erection of site installations	1	Explain the use of pressure vessels and heat exchangers.	The content of the new Unit is similar to that of the old Unit. There is nothing contained in the new Unit that was not in the old Unit.	100% credit transfer from OLD to NEW Units.
	2	Be conversant with maintenance systems on vessels and pipelines		2	Specify the protection and site requirements for pipeline maintenance.		
	3	Understand site safety requirements and current regulations		3	Advise on safe working practices for site organisation and layout		
	4	Understand the various stages when estimating a project		4	Estimate the cost of site pipework installations.		

HN Unit Credit Transfer Grid

HN Units: Fabrication: Preparation, Joining and Assembly AND Fabrication Forming Processes

The following tables show how the Outcomes transfer from the old double credit Unit to the new single credit Units.

New Unit: Fabrication: Preparation, Joining and Assembly	Old Unit: Fabrication Principles: Process, Manufacture and Assembly	Credit Transfer Rec/mend
1 Interpret information and identify symbols used in fabrication engineering drawings and recognise standard marking dimensions in structural steelwork.	1 Explain methods of measurement and marking out;	The Quality Assurance content has been removed — this equated to between 5–10% of Unit content. All other Outcomes remain the same 100% credit transfer from old to new Unit
2 Describe manual, template and computer marking methods in the construction of cambers and layouts used in the fabrication industry.	1 Explain methods of measurement and marking out;	
3 Describe the thermal and mechanical cutting and mechanical joining of materials used in plate and sheet assemblies.	2 Explain current methods of cutting and forming in the fabrication industry;	
4 Describe the methods of work holding, clamping, and controlling distortion	3 Select appropriate fabrication assembly methods in relation to design	

New Unit: Fabrication Forming Processes	Old Unit: Fabrication Principles: Process, Manufacture and Assembly	Credit Transfer Rec/mend
1 Describe processes and techniques adopted in the manufacture of fabricated components in thick plate material.	4 Explain current methods of forming in the fabrication industry	The Quality Assurance content has been removed — this equated to between 5–10% of Unit content. All other Outcomes remain the same 100% credit transfer from old to new Unit
2 Describe processes and techniques adopted in the manufacture of fabricated components in thin plate and sheet material	4 Explain current methods of forming in the fabrication industry	
3 Describe processes and techniques adopted in the manufacture of fabricated components in section/bar material.	4 Explain current methods of forming in the fabrication industry	

HN Unit Credit Transfer Grid

HN Unit: Performing Liquid Penetrant Inspection

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Performing Liquid Penetrant Inspection	1	Know the general theory associated with Liquid Penetrant Inspection	Performing Liquid Penetrant Inspection	1	Explain the general theory associated with Liquid Penetrant Inspection	The only change is the assessment for Outcomes are combined to assimilate the PCN qualification	100% credit transfer from OLD to NEW Units.
	2	Know the theory specific to Liquid Penetrant Inspection		2	Explain the theory specific to Liquid Penetrant Inspection		
	3	Understand the basic production processes tested by Liquid Penetrant Inspection		3	Describe the basic production processes tested by Liquid Penetrant Inspection		
	4	Perform tests on components using a Liquid Penetrant Inspection method		4	Specify and apply a Liquid Penetrant Inspection method on given components		

HN Unit Credit Transfer Grid

HN Unit: Perform Magnetic Particle Inspection

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Performing Magnetic Particle Inspection	1	Know the general theory associated with Magnetic Particle Inspection	Performing Magnetic Particle Inspection	1	Explain the general theory associated with Magnetic Particle Inspection	The only change is the assessment for Outcomes are combined to assimilate the PCN qualification	100% credit transfer from OLD to NEW Units.
	2	Know the theory specific to Magnetic Particle Inspection		2	Explain the theory specific to Magnetic Particle Inspection		
	3	Understand the basic production processes tested by Magnetic Particle Inspection		3	Describe the basic production processes tested by Magnetic Particle Inspection		
	4	Perform tests on components using a Magnetic Particle Inspection method		4	Specify and apply a Magnetic Particle Inspection method on given components		

HN Unit Credit Transfer Grid

HN Unit: Containers: Design and Manufacture

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Containers: Design and Manufacture.	1	Design a container made from a ferrous/non-ferrous material to hold a non-corrosive material.	Manufacture of Containers	1	Design a container made from a ferrous material to hold a non-corrosive material.	The only change is that the new Unit allows the use of non-ferrous metals whereas the old Unit was restricted to ferrous metal	100% credit transfer from OLD to NEW Units.
	2	Formulate a strategy for the manufacture of a container from ferrous/non-ferrous metal		2	Prepare a strategy for the manufacture of a container from ferrous metal		
	3	Carry out the manufacture of the container		3	Complete the manufacture of a container from a ferrous metal		
	4	Carry out the testing of the container		4	Carry out the pressure test of a container		
	5	Analyse the design and fitness for purpose of the completed container		5	Analyse the commercial value of the manufactured container.		

HN Unit Credit Transfer Grid

HN Unit: Inspection Systems

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Inspection Systems.	1	Specify the role of inspection systems in the fabrication industry	Inspection Systems	1	Specify the role of inspection systems in the fabrication industry	The new Unit specifies welding standards and third party inspectors.	100% credit transfer from OLD to NEW Unit.
	2	Identify the components of visual inspection techniques		2	Identify and apply dimensional inspection techniques.	New Unit explores inspection prior, during and after welding.	
	3	Identify surface methods of NDT		3	Identify surface methods of NDT	No requirement for application in Outcome 2 as in old Unit	
	4	Identify sub-surface methods of NDT		4	Identify sub-surface methods of NDT		

HN Unit Credit Transfer Grid

HN Unit: Welding Procedures: Specification, Qualification and Testing

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Welding Procedures: Specification, Qualification and Testing	1	Use current standards codes to define procedure data for a given welding application.	Welding Procedures: Specification, Qualification and Testing	1	Use current standards codes to define procedure data for a given welding application	The only change is that the new Unit does not require weldability tests to be conducted by student or centre	100% credit transfer from OLD to NEW Units.
	2	Conduct weldability assessment for a specific material		2	Conduct weldability assessment for a specific material		
	3	Produce a welding procedure for a specific material		3	Produce a welding procedure for a specific material		
	4	Carry out an inspection of a weldment and complete a test report for a welder working to an approved procedure		4	Carry out an inspection of a weldment and complete a test report for a welder working to an approved procedure		

HN Unit Credit Transfer Grid

HN Unit: Shipbuilding Principles: Planning, Production and Assembly

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Shipbuilding Principles: Planning, Production and Assembly	1	Outline the principles of shipbuilding planning and production control.	Shipbuilding Principles: Planning, Production, Assembly and Repair	1	Advise on the planning methods used in ship production and repair for a simple shipbuilding project	Reduced from four Outcomes down to three	100% credit transfer from OLD to NEW Units.
	2	Describe the principles of modern hull construction		2	Advise on shipyard or workshop layout, equipment and facilities		
	3	Outline the methods of launching large hull vessels		3	Select modern hull construction, outfitting or repair techniques		
				4	Apply the principles of shipbuilding to a chosen practical shipbuilding or repair situation		

HN Unit Credit Transfer Grid

HN Unit: Shipbuilding Principles: Advanced Hull and Associated Techniques

New/revised Unit Title	New/Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
Shipbuilding Principles: Advanced Hull and Associated Techniques	1	Describe hull reinforcement and design of large ships	Shipbuilding Principles: Advanced Hull and Associated Techniques	1	Advise on current advances in hull design and materials technology	The old propulsion and control Outcome 3 will match some of the commissioning work in the new Unit Outcome 4. The old hull design Outcome 1 will match Some of the hull reinforcement in the new Unit Outcome 1	30% credit transfer from OLD to NEW Units.
	2	Describe the general arrangements for large ships		2	Advise on scope and use of classification society rules for special service hulls		
	3	Describe the various methods of docking large vessels		3	Advise on recent advances in propulsion and control equipment		
	4	Describe the various methods used in ship commissioning work during outfitting and sea trials		4	Apply the principles of shipbuilding to a chosen practical hull or associated technology situation		

Appendix 3

Core Skills Map

Opportunities to develop and evidence Core Skills in the HNC Fabrication, Welding & Inspection group award framework

Core Skill		Communication															Inform. Tech.				Numeracy					Problem Solving									Working With Others											
		R		W					O					UIT				UGI		UN			CT			P&O			R&E																	
		a	b	a	b	c	d	e	a	b	c	d	e	a	b	c	d	a	b	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	d	e										
Unit No	Unit Name																																													
D77G 34	Communication: Practical Skills	*	*	*	*	*	*	*	*	*	*	*	*	*	*																								*	*	*	*	*			
DR1X 34	CAD for Engineers													*		*	*	*																												
DR23 34	Containers: Design and Manufacture	*	*	*	*	*	*	*	*	*	*	*	*				*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
DR22 34	Design Analysis: Fabrication & Welding	*	*	*	*	*	*	*									*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*								
DR21 34	Destructive Testing	*	*	*	*	*	*	*									*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*							
DT5R 34	Economics of Manufacture	*	*	*	*	*													*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*							
DR1W 34	Engineering Drawing																*	*					*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		

Opportunities to develop and evidence Core Skills in the HNC Fabrication, Welding & Inspection group award framework

Unit / Core Skill		Communication										Inform. Tech.				Numeracy					Problem Solving									Working With Others															
		R		W					O					UIT				UGI		UN			CT			P&O			R&E																
		a	b	a	b	c	d	e	a	b	c	d	e	a	b	c	d	a	b	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	d	e						
Unit No	Unit Name																																												
DR27 33	Performing Liquid Penetrant Inspection	*	*	*	*	*	*	*										*	*								*	*	*	*	*	*	*	*	*	*	*								
DR28 33	Performing Magnetic Particle Inspection	*	*	*	*	*	*	*										*	*	*	*	*					*	*	*	*	*	*	*	*	*	*	*	*	*						
DR29 34	Pipework 1: Construction and Site Installation	*	*	*	*	*	*	*										*	*							*	*	*	*	*	*	*	*	*	*	*	*	*							
DR2A 34	Pipework 2: Pipe Bending and Pipe System Design	*	*	*	*	*	*	*										*	*							*	*	*	*	*	*	*	*	*	*	*	*	*	*						

