



Group Award Specification for:

**Professional Development Award (PDA) in
Advanced Manufacturing at SCQF level 7**

Group Award Code: GR2M 47

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1 Introduction

This document was previously known as the arrangements document. The purpose of this document is to:

- ◆ assist centres to implement, deliver and manage the qualification
- ◆ provide a guide for new staff involved in offering the qualification
- ◆ inform course managers teaching staff, assessors, learners, employers and HEIs of the aims and purpose of the qualification
- ◆ provide details of the range of learners the qualification is suitable for and progression opportunities

This is the group award specification for the PDA in Advanced Manufacturing at SCQF level 7.

Manufacture is a key priority for Scotland involving a range of industrial sectors. The PDA in Advanced Manufacturing at SCQF level 7 will aid with the skills gap as set out in the sector Skills Investment Plans. The award will also aid with the wider manufacture agenda which is being driven by the Manufacturing Action Plan, which is looking to create 'A Manufacturing Future for Scotland'.

At the route of these developments is the emergence of the Fourth Industrial Revolution where technology and Advanced Manufacture will play a key role in the future of Manufacturing. Based on intelligence gathered from both industry and education in relation to the technology advancements within Manufacturing Industries, there is a clear justification to develop a qualification that incorporates these advanced technologies.

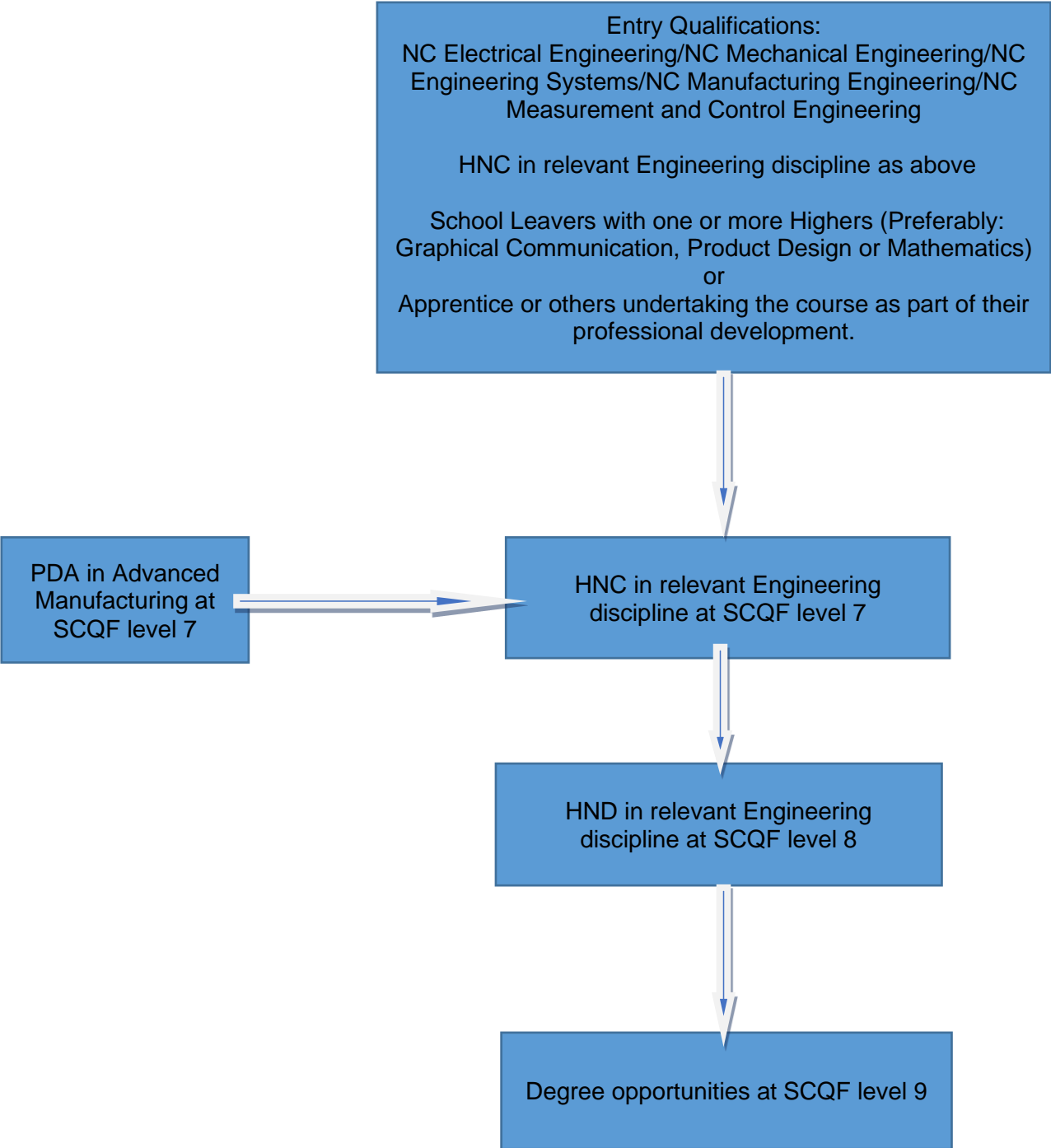
Through discussions within the colleges Short Life Working Group (SLWG), there was a focus on developing a qualification that would support the Manufacturing industry to prepare for Industry 4.0. As well as focusing on the Manufacturing Action Plan, the PDA also supports the recommendations of the **Made Smarter** Review to upskill workers to enable digital technologies to be successfully exploited, with a mandate to develop the UK's own Industry 4.0 domestic and global brand.

The PDA in Advanced Manufacturing will be relevant to a wide range of manufacturing sectors including aerospace, life sciences, pharmaceuticals, food and drink, fashion and textiles as well as the traditional electrical, electronics, marine and mechanical engineering industries. The qualification can be used for upskilling and reskilling of the workforce; as an introduction into engineering for senior phase school students and for forming articulation routes to full HNC/D participation.

The title of the qualification reflects the industrial nature of the award and is linked to the skills required to become competent to work in an advanced manufacturing environment. The qualification will enable learners to develop good technical, investigative and problem solving skills that are required in a broad range of production and manufacturing environments.

In recent years industry has expressed concern over the lack of availability of technically competent people to work in advanced manufacturing industries. Industry has found that university graduates lacked the required skills, which meant that considerable effort had to be put into retraining graduates and existing personnel for jobs. It is envisaged that this flexible and industry tailored PDA will improve learners' employment and progression prospects and will support national strategies and drivers.

The following diagram illustrates potential progression routes:



2 Qualification structure

The PDA in Advanced Manufacturing is made up of 4 SQA unit credits. It comprises 32 SCQF credit points of which 24 are at SCQF level 7 in the mandatory section. This is in line with SQA principles for the design of Professional Development Awards.

2.1 Structure

To achieve the PDA in Advanced Manufacturing, learners must complete three mandatory units and one optional unit.

Mandatory units

Unit code	Unit title	SCQF level	SCQF credit points	SQA credit
J3J3 34	Advanced Manufacturing Technologies	7	8	1
HE29 34	CAD: 3D Printing and Scanning	7	8	1
J0HC 34	Internet of Things	7	8	1

Optional units (one unit required)

Unit code	Unit title	SCQF level	SCQF credit points	SQA credit
DT9Y 35	Robotic Systems	8	8	1
HT9T 34	Artificial Intelligence	7	8	1

3 Aims of the qualification

The main aim of the PDA in Advanced Manufacturing is to provide learners with the opportunity to develop current and future skills matching the needs of industry that includes engineering and manufacturing. The PDA aims to give learners the opportunity to develop industry relevant software and interfacing skills and knowledge of advanced technologies related to the engineering and manufacturing sectors.

In addition, the awards are tailored to provide learners with opportunities to gain knowledge and skills sets appropriate to more formal recognition and to provide progression pathways.

The aims of the qualification have been split into general aims and specific aims.

3.1 General aims of the qualification

- 1 To develop competences required by employers across a range of employment situations.
- 2 To develop knowledge and skills for the purpose of progression to further academic study, either before embarking on a career, or parallel to it.
- 3 To develop key skills for employability while building on previously acquired transferable skills which could allow progression within the SCQF (Scottish Credit and Qualification Framework) or lead to employment.
- 4 To develop skills in study, research, analysis, and improve learner's ability to define and solve problems.
- 5 To develop Core Skills which are capable of being transferred to any type of employment.

3.2 Specific aims of the qualification

- 6 To provide a range of specialised knowledge and skills in areas of Advanced Manufacturing.
- 7 To provide an award that, on successful completion provides learners with the vocational skills and knowledge within the advanced manufacturing that include:
 - New and emerging advanced manufacturing technologies
 - 3D printing and scanning technologies
 - Artificial intelligence and machine learning
- 8 To provide a flexible route to a group award through part time or full time provision.

4 Recommended entry to the qualification

Entry to this qualification is at the discretion of the centre. The following information on prior knowledge, skills, experience or qualifications that provide suitable preparation for this qualification has been provided by the Qualification Design Team as guidance only.

Learners would benefit from having attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience.

- ◆ NC or HNC in a related discipline, these could include but not limited to Electrical Engineering, Mechanical Engineering, Engineering Systems, Manufacturing Engineering and Measurement and Control Engineering;
- ◆ at least one Higher level pass, with appropriate supporting passes at National 5 or equivalent in appropriate subjects, desirably this would include Maths, English, and or a Science subject;
- ◆ SVQ in an Engineering discipline, these could include but not limited to Mechanical, Manufacturing or Electrical Engineering.

Work experience

Mature learners with suitable relevant work experience may be accepted for entry, or advanced entry; provided the enrolling centre believes that the learner is likely to benefit from undertaking the qualifications. Centres may wish to use Core Skills profiling to assist them in this process.

4.1 Core Skills entry profile

The Core Skill entry profile provides a summary of the associated assessment activities that exemplify why a particular level has been recommended for this qualification. The information should be used to identify if additional learning support needs to be put in place for learners whose Core Skills profile is below the recommended entry level or whether learners should be encouraged to do an alternative level or learning programme.

Core Skill	Recommended SCQF entry profile	Associated assessment activities
Communication	5	Good communication skills will be required for learners doing this qualification as they will need to research, analyse, report, and present technical data and documentation.
Numeracy	5	Good numerical skills will be required for learners doing this qualification as they will need to use a range of numerical skills for a range of tasks.
Information and Communication Technology (ICT)	5	Good ICT skills are core to this qualification. Learners will need a sound understanding of basic ICT as the foundation to use the systems to search online material for research purposes.
Problem Solving	5	Critical thinking, planning and organising, and reviewing and evaluating are fundamental to all elements of this qualification.
Working with Others	5	Working as part of a team co-operatively is essential when progressing to industry. There are several opportunities throughout this award for working with others to take place.

5 Additional benefits of the qualification in meeting employer needs

This qualification was designed to meet a specific purpose and what follows are details on how that purpose has been met through mapping of the units to the aims of the qualification. Through meeting the aims, additional value has been achieved by linking the unit standards with those defined in National Occupational Standards and/or trade/professional body requirements. In addition, significant opportunities exist for learners to develop the more generic skill, known as Core Skills through undertaking this qualification.

5.1 Mapping of qualification aims to units

Code	Unit title	Aims							
		1	2	3	4	5	6	7	8
J3J3 34	Advanced Manufacturing Technologies	X	X	X	X	X	X	X	X
HE29 34	CAD 3D Printing and Scanning	X	X	X	X	X	X	X	X
J0HC 34	Internet of Things	X	X	X	X	X	X		X
DT9Y 35	Robotic Systems	X	X	X	X	X	X		X
HT9T 34	Artificial Intelligence	X	X	X	X	X	X		X

5.2 Mapping of National Occupational Standards (NOS)

The following table provides an overview to the SQA Units within the PDA Advanced Manufacturing Awards and links to relevant National Occupational Standards. The units listed cover elements of the underpinning knowledge identified within the NOS.

Code	Unit title	National Occupational Standard									
		1	2	3	4	5	6	7	8	9	10
J3J3 34	Advanced Manufacturing Technologies	X	X							X	
HE29 34	CAD 3D Printing and Scanning	X	X	X		X			X	X	
J0HC 34	Internet of Things				X	X			X	X	X
DT9Y 35	Robotic Systems	X		X	X	X	X	X	X	X	
HT9T 34	Artificial Intelligence	X	X		X		X	X	X	X	X

National Occupational Standards (NOS) for Engineering and Manufacturing Suite 4

Engineering Technicians

Map no	NOS number	NOS unit	Map no	NOS number	NOS unit
1	SEMETS3-62	Determining engineering software requirements	6	SEMETS3-68	Performing engineering software configuration management
2	SEMETS3-63	Producing engineering software design	7	SEMETS3-69	Performing engineering software acquisition
3	SEMETS3-64	Producing engineering software implementation	8	SEMETS3-70	Performing engineering software safety assessments
4	SEMETS3-65	Testing engineering software	9	SEMETS3-71	Performing low level programming for engineering software
5	SEMETS3-66	Performing engineering software analysis techniques	10	SEMETS3-72	Performing computer system security assessments for engineering software

5.3 Mapping of Core Skills development opportunities across the qualification

Unit code	Unit title	Communication			Numeracy		ICT		Problem Solving			Working with Others	
		Written (Reading)	Written (Writing)	Oral	Using Number	Using Graphical Information	Accessing Information	Providing/Creating Information	Critical Thinking	Planning and Organising	Reviewing and Evaluating	Working Co-operatively with Others	Reviewing Co-operative Contribution
J3J3 34	Advanced Manufacturing Technologies	S6	S6		S6	S6	S6	S6	S6	S6	S6		
HE29 34	CAD: 3D Printing and Scanning	S6	S6	S6	S6	S6			S6	S6	S6	S6	S6
J0HC 34	Internet of Things	S6	S6	S6					E5				
DT9Y 35	Robotic Systems		S6		S6				S6		S6	S6	S6
HT9T 34	Artificial Intelligence						S6	S6	E5	S6	S6		

E — Embedded Core Skills

S — Signposted Core Skills

5.4 Assessment strategy for the qualification

In the majority of units, theory-based outcomes are assessed holistically by means of an end of unit closed-book assessment under controlled conditions. Practical outcomes are evidenced by a variety of means; please consult individual unit specifications for clarification and details of arrangements.

Unit	Assessment
J3J3 34 Advanced Manufacturing Technologies	Learners will require to provide evidence to demonstrate the knowledge and/or skills across all outcomes. The evidence requirements for this unit will take two forms; Knowledge evidence (Outcomes 1 and 2) through traditional testing and product evidence (Outcomes 3) where the research activity will require learners to explore an industrial use of an emerging Advanced Manufacturing Technology.
HE29 34 CAD 3D Printing and Scanning	Due to the emulation of a project based working environment the assessment for this unit could be integrated. Outcomes 1–4 could be assessed as one complete project. However, the unit can be delivered in order with Outcome 1 being worked on continuously throughout Outcomes 2–4 at the discretion of the centre.
J0HC 34 Internet of Things	Learners will require to provide evidence to demonstrate the knowledge and/or skills across all outcomes. The evidence requirements for this unit will take two forms; knowledge evidence (Outcomes 1 and 2) through traditional testing and product evidence (Outcomes 3 and 4) where a more hands-on approach will be adopted.
DT9Y 35 Robotic Systems	Assessment of Outcomes 1 and 2 must be combined together into a single assessment paper based around a case study. Learners will be provided with a copy of the case study and robotic systems topic areas relevant to the study at least 20 days before they sit the assessment. The assessment, which should last no more than two hours, must be conducted under controlled, supervised conditions. Learners will be permitted to bring into the assessment information they have gathered as a result of their research. Outcome 3 must be assessed by practical assignment. Learners must complete the practical assignment in two hours under supervised conditions.
HT9T 34 Artificial Intelligence	A traditional approach to (summative) assessment could involve a multiple-choice test (for knowledge evidence) and a practical assignment (for product evidence).

6 Guidance on approaches to delivery and assessment

The PDA in Advanced Manufacturing aims to give learners the opportunity to develop industry relevant knowledge and skills of the emerging technologies within the advanced manufacturing engineering sector.

The qualification has relevant unit specifications that provide detailed guidance on the content, delivery and assessment of the unit. Where possible and appropriate, integrated assessments should be used to provide a more holistic approach to assessing learners.

A distance learning delivery mode would be possible provided adequate materials, tutorial support, assessment facilities and laboratory time exist. Centres should note however that assessed practical activities must take place under supervised conditions.

Centres will define which order the units are undertaken based on learner recruitment patterns, mode of delivery, resource implications, and logical progression.

Assessment Support Packs (ASPs) are available for some of the units included in this qualification. Centres can use the ASPs for assessment purposes as long as they are kept secure. ASPs may be used by centres as a guide and/or template for producing locally devised assessments.

6.1 Sequencing/integration of units

The structure of the PDA allows for flexibility in the mode of delivery. It may be possible for centres to combine integrated assessments bringing together the units — *Advanced Manufacturing Technologies* and *CAD: 3D Printing and Scanning*, through the evaluation of 3D scanning technology. There are also other opportunities to develop an integrated assessment approach between the unit *Advanced Manufacturing Technologies* and either of the optional units.

The group award lends itself to a wide range of delivery mechanisms including formal teaching, case studies, group work, tutorials and laboratory/practical work. A number of units specifically indicate some of these approaches are to be utilised in assessment therefore it is important that learners have experienced them throughout the learning process.

6.1.1 Delivery schedule

PDA in Advanced Manufacturing — Suggested sequencing of delivery

Semester 1			Semester 2		
Unit code	Unit title	SQA credit	Unit code	Unit title	SQA credit
J3J3 34	Advanced Manufacturing Technologies	1	J0HC 34	Internet of Things	1
HE29 34	CAD: 3D Printing and Scanning	1	Optional unit DT9Y 35 or HT9T 34	Robotic Systems or Artificial Intelligence	1
Total SQA credits		2	Total SQA credits		2

The inclusion of SCQF level 7 unit in *Advanced Manufacturing Technologies* provides an opportunity to support learners who have limited prior knowledge of historical trends and emerging themes within advanced manufacturing technologies. The opportunity to undertake this unit should be sequenced at an early stage of delivery as it will provide the underpinning knowledge required to support the delivery of the other units within the group award.

6.2 Recognition of prior learning

SQA recognises that learners gain knowledge and skills acquired through formal, non-formal and informal learning contexts.

In some instances, a full group award may be achieved through the recognition of prior learning. However, it is unlikely that a learner would have the appropriate prior learning and experience to meet all the requirements of a full group award.

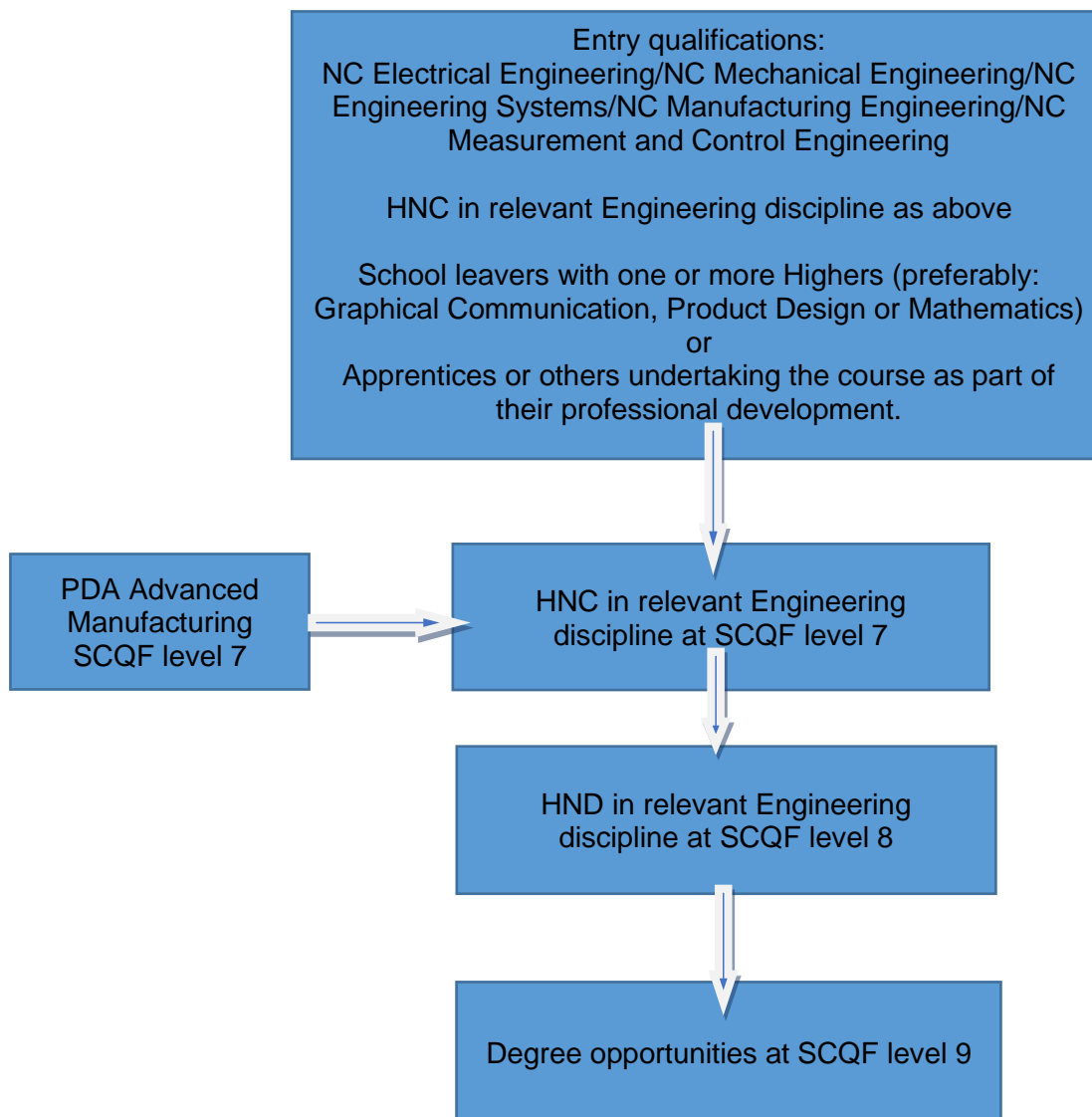
The recognition of prior learning may **not** be used as a method of assessing in the following types of units and assessments:

- ◆ HN Graded Units
- ◆ Course and/or external assessments
- ◆ Other integrative assessment units (which may or not be graded)
- ◆ Certain types of assessment instruments where the standard may be compromised by not using the same assessment method outlined in the unit
- ◆ Where there is an existing requirement for a licence to practice
- ◆ Where there are specific health and safety requirements
- ◆ Where there are regulatory, professional or other statutory requirements
- ◆ Where otherwise specified in an assessment strategy

More information and guidance on the *Recognition of Prior Learning* (RPL) may be found on our website www.sqa.org.uk.

The following sub-sections outline how existing SQA unit(s) may contribute to this group award. Additionally, they also outline how this group award may be recognised for professional and articulation purposes.

6.2.1 Articulation and/or progression



6.3 Opportunities for e-assessment

E-assessment may be appropriate for some assessments in the units comprising this group award. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software.

Centres that wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at www.sqa.org.uk/e-assessment

6.4 Support materials

A list of existing ASPs is available to view on SQA's website.

6.5 Resource requirements

Delivering centres will require appropriate engineering teaching laboratories and technical support as well as appropriate practical resources to support the delivery of the practical elements of the PDA in Advanced Manufacturing.

Centres must ensure that specific requirements in terms of documents, texts and IT resources to support the learning processes within the PDA are met. All staff delivering the PDA in Advanced Manufacturing group award must hold a qualification appropriate to the unit(s) delivered.

7 General information for centres

Equality and inclusion

The unit specifications making up this group award have been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners will be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. 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 qualification(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* (www.sqa.org.uk/GuideToAssessment).

8 Glossary of terms

Embedded Core Skills: is where the assessment evidence for the unit also includes full evidence for complete Core Skill or Core Skill components. A learner successfully completing the unit will be automatically certificated for the Core Skill. (This depends on the unit having been successfully audited and validated for Core Skills certification.)

Finish date: The end of a group award's lapsing period is known as the finish date. After the finish date, the group award will no longer be live and the following applies:

- ◆ learners may not be entered for the group award
- ◆ the group award will continue to exist only as an archive record on the Awards Processing System (APS)

Lapsing date: When a group award is entered into its lapsing period, the following will apply:

- ◆ the group award will be deleted from the relevant catalogue
- ◆ the group award specification will remain until the qualification reaches its finish date at which point it will be removed from SQA's website and archived
- ◆ no new centres may be approved to offer the group award
- ◆ centres should only enter learners whom they expect to complete the group award during the defined lapsing period

SQA credit value: The credit value allocated to a unit gives an indication of the contribution the unit makes to an SQA group award. An SQA credit value of 1 given to an SQA unit represents approximately 40 hours of programmed learning, teaching and assessment.

SCQF: The Scottish Credit and Qualification Framework (SCQF) provides the national common framework for describing all relevant programmes of learning and qualifications in Scotland. SCQF terminology is used 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: SCQF credit points provide a means of describing and comparing the amount of learning that is required to complete a qualification at a given level of the framework. One National Unit credit is equivalent to 6 SCQF credit points. One National Unit credit at Advanced Higher and one Higher National Unit credit (irrespective of level) is equivalent to 8 SCQF credit points.

SCQF levels: The level a qualification is assigned within the framework is an indication of how hard it is to achieve. The SCQF covers 12 levels of learning. HNCs and HNDs are available at SCQF levels 7 and 8 respectively. Higher National Units will normally be at levels 6–9 and graded units will be at level 7 and 8. 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.

Subject unit: Subject units contain vocational/subject content and are designed to test a specific set of knowledge and skills.

Signposted Core Skills: refers to opportunities to develop Core Skills arise in learning and teaching but are not automatically certificated.

History of changes

It is anticipated that changes will take place during the life of the qualification and this section will record these changes. This document is the latest version and incorporates the changes summarised below. Centres are advised to check SQA's APS Navigator to confirm they are using the up to date qualification structure.

NOTE: Where a unit is revised by another unit:

- ◆ No new centres may be approved to offer the unit which has been revised.
- ◆ Centres should only enter learners for the unit which has been revised where they are expected to complete the unit before its finish date.

Version Number	Description	Date

Acknowledgement

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of this qualification.

9 General information for learners

This section will help you decide whether this is the qualification for you by explaining what the qualification is about, what you should know or be able to do before you start, what you will need to do during the qualification and opportunities for further learning and employment.

The PDA in Advanced Manufacturing at SCQF level 7 is a vocational qualification providing the knowledge and skills required to allow for progression to further study and employment in a wide range of manufacturing sectors including aerospace, life sciences, pharmaceuticals, food and drink, fashion and textiles as well as the traditional electrical, electronics, marine and mechanical engineering industries.

The qualification aims to:

- ◆ prepare you for an appropriate level of employment.
- ◆ develop a range of contemporary vocational skills relating to the use, support and development of systems appropriate to employment at technician or professional level.
- ◆ provide you with an element of vocational specialisation in a variety of areas.
- ◆ prepare you for progression for further studies in engineering related disciplines.
- ◆ provide a flexible route to the group award, allowing access to those in employment through part-time study and full-time provision.
- ◆ develop study, research and analysis skills.
- ◆ provide opportunities to develop Core Skills.
- ◆ provide you with a range of practical skills to further enhance job prospects through the practical content of the course.

The PDA is considered suitable for anyone looking to enhance their skills in the technological advancements within the advanced manufacturing industry to meet the requirements of Industry 4.0. It is considered to be particularly beneficial for those who are already in employment within a manufacturing sector including aerospace, life sciences, pharmaceuticals, food and drink, fashion and textiles as well as the traditional electrical, electronics, marine and mechanical engineering industries.

To achieve the PDA in Advanced Manufacturing at SCQF level 7 you must complete three mandatory units and one optional unit. You should liaise with your lecturer to ensure that you complete the necessary units to achieve the group award and that progression routes remain open to you.