National Unit Specification: general information

UNIT Plant Maintenance Practice (SCQF level 6)

CODE F5J9 12

SUMMARY

This Unit may form part of a National Qualification Group Award or may be offered on a free standing basis.

This largely practical Unit is designed to provide candidates with knowledge, understanding and skills in mechanical plant maintenance. During delivery of the Unit candidates will learn to describe and analyse plant maintenance strategies. They will also learn to carry out necessary tasks prior to undertaking maintenance on given plant systems. Candidates will develop the knowledge and skills to dismantle parts of given plant systems and carry out systematic fault finding to detect and remedy faults on equipment making up the plant system. On completion of the maintenance tasks and reassembly of plant systems candidates will complete maintenance documentation and will perform tests to ensure plant systems are operating according to specification. Candidates will learn to apply safe working procedures and practices throughout the delivery of the Unit.

This Unit is suitable for candidates training to be maintenance, mechanical or multi-disciplinary engineering technicians.

OUTCOMES

1 Describe and analyse plant maintenance strategies.
2 Carry out necessary preparations prior to undertaking maintenance on a given plant system.
3 Carry out given maintenance tasks on a given plant system.
4 Report on the completed maintenance and test reassembled plant system.

Administrative Information

Superclass: VG

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National Unit Specification: general information (cont)

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RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained the following or equivalent.

- Plant Maintenance Practice (SCQF level 5)
- Appropriate industrial experience in the field of mechanical plant maintenance

CREDIT VALUE

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6*).

*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

CORE SKILLS

There is no automatic certification of Core Skills in this Unit.

The Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- Communication (SCQF level 6)
- Problem Solving (SCQF level 6)
- Working with Others (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

National Unit Specification: statement of standards

UNIT Plant Maintenance Practice (SCQF level 6)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit Specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME 1

Describe and analyse plant maintenance strategies.

Performance Criteria

(a) Describe correctly different types of plant maintenance strategies.
(b) Compare correctly the advantages and disadvantages of different types of plant maintenance strategies.

OUTCOME 2

Carry out necessary preparations prior to undertaking maintenance on a given plant system.

Performance Criteria

(a) Draw correctly a schematic diagram of the given plant system identifying clearly all services connected to the system.
(b) Complete correctly a Risk Assessment in connection with maintenance on the given plant system.
(c) Complete correctly, and get approval for, a Permit to Work in connection with maintenance on the given plant system.
(d) Participate effectively in a work team meeting prior to starting maintenance tasks.

OUTCOME 3

Carry out given maintenance tasks on a given plant system.

Performance Criteria

(a) Disconnect correctly and safely services from given plant system.
(b) Demonstrate correctly an ability to follow instructions in manufacturers' manual/procedures while performing maintenance tasks.
(c) Dismantle correctly given plant equipment using appropriate tools and techniques and in accordance with manufacturers' manual/procedures and Risk Assessment.
(d) Carry out correctly systematic fault finding on plant equipment and repair or replace and report any faulty component(s).
(e) Reassemble correctly plant system using appropriate tools and techniques and in accordance with manufacturers' manual/procedures and Risk Assessment.
(f) Comply fully with safety procedures and practices, good housekeeping and appropriate tool/equipment storage while performing all maintenance tasks.

National Unit Specification: statement of standards (cont)

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OUTCOME 4

Report on the completed maintenance and test reassembled plant system.

(a) Reconnect correctly and safely services to given plant system.
(b) Close out correctly Permit to Work document.
(c) Carry out appropriate tests on given plant system to ensure plant operates according to specification.
(d) Complete correctly maintenance documentation.

EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral and performance evidence supplemented with an assessor observation checklist should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria.

Outcomes 1, 2, 3 and 4 may be assessed on an individual basis, or as a combination of Outcomes (eg Outcome 1 on its own and Outcomes 2, 3 and 4 together) or as a single, holistic assessment. Which ever approach is taken, assessment of the Outcomes must take place at suitable points in the delivery of the Unit. Assessment of Outcome 1 must last no more than 45 minutes and must be conducted under supervised, closed-book conditions in which candidates are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment. Assessment of Outcomes 2, 3 and 4 must be conducted under supervised, open-book conditions.

With regard to Outcome 1

- candidates must describe three different types of maintenance strategies from the following: planned preventative, breakdown, schedule, periodic, condition monitoring or any suitable other
- candidates must compare the advantages and disadvantages of three of the following maintenance systems: planned preventative, breakdown, schedule, periodic, condition monitoring or any suitable other

With regard to Outcomes 2, 3 and 4

- the given item of plant must consist of a minimum of two separate items of equipment (eg motor and pump)

With regard to Outcome 2

- as part of the Risk Assessment candidates must identify five hazards associated with the maintenance tasks, estimate the level of risk associated with each hazard and identify steps to minimise the risk(s) associated with each hazard

National Unit Specification: statement of standards (cont)

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With regard to Outcome 3

- candidates should make all mechanical and electrical service disconnections under the close supervision of a person deemed qualified and approved by the centre to deliver the Unit
- at least one item of equipment in the plant system must contain a minimum of one fault
- during dismantling, repair and reassembly candidates must:
  - wear appropriate PPE at all times in engineering workshop areas
  - demonstrate appropriate workshop safety behaviours at all times
  - use an appropriate marking procedure (eg witness marking) when dismantling and reassembling an item of equipment
  - where appropriate, identify and use dismantling and re-assembly aids (penetrating fluids, heat, special tools, specialist adhesives and assembly compounds)
  - where appropriate, identify and apply correct torque settings to component fastenings during re-assembly
  - identify and correctly apply appropriate lubricants during re-assembly

With regard to Outcome 4

- candidates should carry out those test deemed appropriate to ensure the plant system operates according to specification. Plant should be monitored over a short period of time to ensure proper operation. All tests must be carried out under close supervision of a person deemed qualified and approved by the centre to deliver the Unit.
- candidates must complete appropriate maintenance document such as a report form or job card either on paper or electronically.

The Assessment Support Pack for this Unit provides sample assessment material. Centres wishing to develop their own assessments should refer to the Assessment Support Pack to ensure a comparable standard.

National Unit Specification: support notes

UNIT Plant Maintenance Practice (SCQF level 6)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This Unit forms part of the National Qualification Group Award in Mechanical Engineering at SCQF level 6, but may also be offered on a free standing basis.

The aim of this Unit is to provide candidates with knowledge, understanding and skills in mechanical plant maintenance. On successful completion of the Unit candidates will be able to describe and analyse plant maintenance strategies. They will have learnt to carry out the necessary tasks prior to undertaking maintenance on given plant systems. Candidates will also have developed the knowledge and skills to dismantle parts of plant systems and be capable of carrying out systematic fault finding to detect and remedy faults on equipment making up plant systems. On completing maintenance tasks and reassembling plant systems candidates will be able to complete appropriate maintenance documentation and will also be able to perform tests on plant systems to ensure such systems operate according to specification.

Candidates may perform maintenance on the following types of plant systems (the list is not intended to be exhaustive):

- prime mover/pump arrangement
- prime mover/compressor arrangement
- pneumatic or hydraulic circuits
- conveyor systems
- robotic arms

In Outcome 1 candidates should be provide with opportunities to explore different types of maintenance strategies. Such strategies should include planned preventative, breakdown, schedule, periodic, condition monitoring or any suitable other. Candidates should be encouraged to analyse each strategy in terms of its advantages and disadvantages over alternative strategies.

In Outcome 2 candidates should be taught about preparations required prior to undertaking maintenance tasks. These should include drawing schematic diagrams of given plant systems which should include identification of all services, learning about and completing Risk Assessment forms as applied to maintenance on given plant systems, learning about and completing Permit to Work documentation and participating in on-site work team meetings prior to undertaking maintenance tasks. Risk Assessments should be produced by taking account of manufacturers' instructions, the working environment and relevant safety standards.

Outcome 3 involves candidates in practical activities in which they should be encouraged to develop the knowledge and skills to dismantle, repair and reassemble given plant systems. Candidates should learn to dismantle equipment following manufacturer's instructions. During the course of dismantling equipment candidates should use, where necessary, aids such as penetrating fluids, heat or special tools to remove unserviceable components.

National Unit Specification: support notes (cont)

Systematic fault finding practices and procedures should take place pre and post dismantling of equipment. Such systematic fault-finding may involve a combination of human senses, previous experience and appropriate diagnostic equipment.

Having diagnosed the fault(s) candidates should decide whether to repair or replace faulty components. Once repair/replacement has been affected the plant system should be reassembled using manufacturers' instructions. During delivery of the Outcome candidates should learn to select, use and store tools correctly and apply safe working procedures and practices at all times.

In Outcome 4 candidates should learn to complete simple maintenance documentation such as a report form or job card on paper or electronically. They should be taught how to carry out necessary tests on reassembled plant systems to ensure systems operate according to specification. All such tests should be carried out by candidates under the close supervision of a person deemed qualified and approved by the centre to deliver the Unit

Ideally each candidate should have the opportunity to work on plant systems on their own. However, from a practical point of view this may not always be possible and candidates may need to work in groups. However, where group work takes place centres should check that candidates are generating sufficient evidence on their own to meet the Outcome and Performance Criteria. Group working has the added advantage of enhancing the co-operative working skills of the candidates.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

It is recommended that the Unit is delivered in the same sequence the Outcomes are presented in the National Unit Specification: statement of standards section of the Unit. Delivery of Unit content should be principally by lecturer demonstration followed by candidates practicing the skills demonstrated although classroom/workshop teaching may be used for subjects such as safety legislation (permit to work/test, risk assessment, etc), different maintenance strategies, maintenance documentation requirements, approaches to systematic faultfinding and the necessary preparations prior to performing maintenance tasks. Prior to performing maintenance on plant candidates should meet in groups to discuss issues relevant to the maintenance tasks. Such issues may include (the list is not intended to be exhaustive):

- clarifying manufacturer's instructions on dismantling and reassembling items of equipment
- agreeing the range of tools and equipment (eg diagnostic equipment) that should be used during the dismantling, repair and reassembly of items of equipment
- discussing how to overcome any problems which they may encounter while dismantling, repairing and reassembling an item of equipment
- discussing approaches to systematic fault finding on given plant systems
- deciding which tests should be performed on the reassembled plant systems to ensure they are operating according to specification

Centres may choose to use appropriate computer simulation software to allow candidates further opportunities to develop their fault-finding skills but this should not be used at the detriment of practical workshop experience.

Centres may choose to store manufacturers' instructions, diagrams and maintenance documents in paper or electronic format. Where the latter is used centres should ensure that candidates have access to computers in the workshop so that they can source such instructions, diagrams and documents easily.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The Oral Communication Core Skill component at SCQF level 6 may be developed in Outcomes 2, 3 and 4 while candidates engage in work team meetings and while they work in groups while carrying out maintenance tasks.

The Critical Thinking Core Skill component at SCQF level 6 may be developed in Outcomes 3 and 4 while candidates are dismantling and reassembling plant systems, engaging in systematic fault finding on defective equipment and carrying out tests on plant systems to ensure they are operating within specification.

The Working with Others Core Skill at SCQF level 5 may be developed in Outcomes 2, 3 and 4 while candidates engage in team meetings and in group work as they have to interact with their lecturers, support staff and other candidates, for example while sharing engineering workshop areas, tools and equipment. Many maintenance tasks are carried out in a noisy environment using ear defenders where verbal communication is almost impossible, however each member of a maintenance team will learn to follow the work in hand, ready to step in at the appropriate moment with a helping hand, or a tool. An interesting exercise might be to practice this skill within a group.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments in this Unit. 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 e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).*

Centres are encouraged to use formative assessment extensively as it plays a particularly important role in allowing candidates to develop a sound knowledge, understanding and skills in maintenance strategies, carrying out preparations prior to undertaking maintenance tasks, dismantling, fault-finding and reassembling plant and completing maintenance documentation and testing plant systems to ensure they operate according to specification.

Outcome 1 may be assessed by an assessment paper comprising of a suitable balance of short answer and restricted questions, or objective questions (eg multi-choice questions) or a combination of both. This assessment may be suitable for on-line delivery.

National Unit Specification: support notes (cont)

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Outcomes 2, 3 and 4 may be assessed by an assignment involving suitable preparations prior to undertaking maintenance on given plant, the dismantling, repair and reassembly of the plant, completing maintenance records and testing plant to ensure it operates according to specification. A suitable checklist(s) should be developed to record evidence of candidate achievement in the Outcomes and Performance Criteria.

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**