National Unit Specification: general information

UNIT Land-based Engineering: Heavy Construction Plant (SCQF level 6)

CODE F91L 12

SUMMARY

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

This Unit is designed to provide candidates with knowledge and understanding of a range of large/heavy construction plant equipment. During the delivery of the Unit candidates will develop a knowledge of the construction and working principles of machines and components of plant used in the plant equipment industry. They will also develop the knowledge and skills to perform fault-finding techniques, repair, test components from the equipment. Candidates will develop practical skills and safe working practices whilst removing, replacing and servicing large/heavy plant components. Particular emphasis will be placed on lifting and handling of large and heavy components.

This Unit is suitable for candidates training to be service engineering technicians.

OUTCOMES

1 Describe the purpose, layout and working principles of large/heavy construction plant machines.
2 Inspect and report on the condition of used large/heavy construction plant machines.
3 Dismantle, assess, repair, re-assemble, and test large/heavy construction plant machines and their sub- assemblies

Administrative Information

Superclass: SK

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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 at least one of the following, or equivalent:

- *Land-based Engineering: Engine Technology* at SCQF level 6
- *Land-based Engineering:Piston Engine Repair Skills* at SCQF level 6
- *Land-based Engineering: Small Construction Plant* at SCQF level 6
- *Land-based Engineering: Workshop Processes* at SCQF level 6
- *Communication* at SCQF level 5
- *Numeracy* at SCQF level 5

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 the candidate to develop aspects of the following Core Skills:

ICT	(SCQF level 5)
Communication	(SCQF level 5)
Numeracy	(SCQF level 4)
Problem Solving	(SCQF level 5)
Working with Others	(SCQF level 5)

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

National Unit Specification: statement of standards

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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 the purpose, layout and working principles of large/heavy construction plant machines.

Performance Criteria

(a) Identify and describe the purpose of large/heavy construction plant machines and their sub-assemblies
(b) Describe correctly the working principles and function of access platforms, cranes and lifting equipment.
(c) Describe correctly the application of the relevant lifting regulations.
(d) Describe correctly the working principles and function of track transmission components.
(e) Describe correctly the working principles and function of 360deg excavators.
(f) Describe correctly the working principles and function of backhoe loaders.
(g) Describe correctly the working principles and function of fork lift trucks.
(h) Describe correctly the working principles and function of skid steer loaders.
(i) Describe correctly the working principles and function of front shovels.
(j) Describe correctly the working principles and function of scrapers and graders and compactors.

OUTCOME 2

Inspect and report on the condition of used large/heavy construction plant machines.

Performance Criteria

(a) Large plant is safely started, run, tested and stopped in accordance with the manufacturers' recommendations.
(b) Identify correctly the condition of lifting equipment.
(c) Identify correctly the condition of plant components and report accurately the serviceability of the machine.
(d) Identify correctly damage associated with incorrect operation of the machine.
(e) Identify out of season maintenance tasks and decommissioning procedures.

OUTCOME 3

Dismantle, assess, repair, re-assemble, and test large/heavy construction plant machines and their sub-assemblies

Performance Criteria

(a) Carry out the dismantling, inspection and repair of heavy construction plant in accordance with manufacturer's recommendations.
(b) Re-assemble and test the sub-assembly mechanisms of heavy construction plant in accordance with manufacturer's recommendations.

National Unit Specification: statement of standards (cont)

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(c) Carry out dismantling, inspection and repair of the sub-assembly components of track unit assemblies.
(d) Carry out alignment, tension and drive checks and adjust the component's track transmission system.
(e) Select and use appropriate tools in accordance with industry convention.
(f) Carry out final safety checks on serviced/repaired plant.
(g) Carry out decommissioning procedures of surplus plant.

National Unit Specification: statement of standards (cont)

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EVIDENCE REQUIREMENTS FOR THIS UNIT

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.
Written and/or recorded oral, product and performance evidence supplemented with an assessor observation checklist(s) should be produced to demonstrate that a candidate has achieved all Outcomes and Performance Criteria

Range of Large/Heavy Plant to be selected for Outcomes of this Unit

	Track-layer sub-assembly	**Access platform**	**Cranes**	**Fork Lift Trucks**	**Back hoe Loaders**	**360 deg Excavator**	**Scrapers Graders**	**Front Shovels**	**Skid Steer Loaders**	**Compactor**
Outcome 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Outcome 2 Inspect two machines for this Outcome	**No**	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2	Option for Inspection in Outcome 2
Outcome 3 Repair one machine and a track sub - assembly for this Outcome	Mandatory Repair one track sub - assembly	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2	Option for Repair in Outcome 3 if the machine was not previously chosen for inspection in Outcome 2

Outcome 1

Outcome 1 must be assessed by a single assessment designed to ensure that candidates can generate sufficient evidence to satisfy the Outcome and Performance Criteria. Candidate evidence must be in the form of written and/or recorded oral evidence. Assessment 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. The assessment should holistically cover the commonly available large/heavy construction plant machines. Total assessment time for Outcome 1 must not exceed 1 hour.

With regard to Outcome 1

- candidates must describe correctly the purpose of four large heavy construction plant machines
- candidates must describe correctly the application of lifting and handling equipment for heavy and large plant and components
- candidates must describe correctly the application of three relevant lifting regulations
- candidates must describe correctly the working principles and function of the transmission systems of a track laying vehicle
- candidates must describe correctly the working principles and function of one item of equipment — **either** an access platform, **or** a crane

- candidates must describe correctly the working principles and function of conventional and telescopic masted fork lift trucks
- candidates must describe correctly the working principles and function of backhoe loaders
- candidates must describe correctly the working principles and function of 360deg excavators
- candidates must describe correctly the working principles and function of skid steer loaders
- candidates must describe correctly the working principles and function of front shovels
- candidates must describe correctly the working principles and function of scrapers graders and compactors

Outcome 2

Outcome 2 must be assessed by a series of assessments designed to generate evidence of candidates' abilities to find faults in two different types of large/heavy construction plant machines one of which should be a track layering vehicle.
Candidates must undertake assessment on their own which should be conducted under supervised conditions. Candidate evidence must be in the form of performance and written and/or recorded oral evidence. An observation checklist must be used to record the evidence of candidates having satisfied all the Performance Criteria in the Outcome.

With regard to Outcome 2

- candidates must report accurately on the serviceability of each sub-assembly, including the prime mover, drive of two large wheeled construction plant machines
- candidates must identify correctly potential sources of excess wear on two items of large construction plant
- candidates must identify basic maintenance tasks for two items of large construction plant machines in accordance with the manufacturers' recommendations
- candidates must identify out of season maintenance tasks and decommissioning procedures for one large construction plant machine in accordance with the manufacturer's recommendations and customer requirements
- candidates must produce an accurate job card report describing the serviceability of the construction plant machine
- assessment must be conducted under supervised conditions

Outcome 3

Outcome 3 must be assessed by a series of assessments designed to generate evidence of candidates' abilities to dismantle, inspect, repair, rectify and/or adjust one complete large/heavy construction plant machine. Additionally if this machine is not a tracklayer, candidates must inspect, dismantle, inspect, repair and/or adjust a track sub-assembly on another item of plant. Emphasis should be placed on the sub-assemblies **not** assessed in other Land-based Engineering units (ie engines or transmissions). See Support Notes Guidance on learning and teaching, also on assessment.
Candidates must undertake the assessment under supervised conditions, which may be in small groups (2/3 persons), but each candidate should be assessed individually.

National Unit Specification: statement of standards (cont)

UNIT Land-based Engineering: Heavy Construction Plant (SCQF level 6)

- candidates must dismantle, inspect, repair/adjust and test the construction plant machine in accordance with manufacturer's recommendations
- candidates must identify the condition, dismantle, inspect, repair/adjust and test the track sub-assembly of a tracklayer
- candidates must use appropriate tools and conform to convention in their use
- candidates must use safe working practice and approved lifting and handling equipment in the workshop situation
- candidates must produce an accurate job card describing the serviceability of the construction plant machine
- observation checklist as evidence of the candidate's ability to follow instructions, use correct tools, observe relevant/set safety requirements for the given tasks and carry out service and test procedures correctly and within realistic time scales

National Unit Specification: support notes

UNIT Land-based Engineering: Heavy Construction Plant (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 Land-based Engineering at SCQF level 6, but may also be offered on a free standing basis. It can operate in conjunction with the SVQ Level 3 in Land-based Engineering Operations, providing candidates with the knowledge and understanding required to service and repair heavy construction plant.

The aim of this Unit is to develop their knowledge, understanding and skills of large construction plant equipment from the following groups:

- track layering vehicles
- access platforms
- cranes
- conventional and telescopic masted fork lift trucks
- backhoe loaders
- 360deg excavators
- compactors
- graders
- front shovels
- scrapers
- skid steer loaders

The candidate could be given the opportunity to examine in a practical location large/heavy construction plant including, identification of the main components, layout, principles of operation of the systems and sub-assemblies. Factors affecting areas of potential wear and failure, settings, adjustments, and the effect of incorrect operational settings/adjustments. Demonstration of the techniques of removal, inspection and replacement procedures for components from construction plant. Candidates must dismantle and inspect the track assemblies of track layering vehicles.

Worn plant components should be inspected and compared to manufacturers' specifications and new components. Due regard for cost of new replacement parts should be impressed on the candidates in line with industry practice.

Practical application of the relevant lifting and handling regulations so that assemblies and complete machines can be manipulated safely. Correct use of tools and observation of safe working practices should be encouraged at all times. The potential hazards associated with fluids, dust, heat and disposal of fluids.

National Unit Specification: support notes (cont)

UNIT Land-based Engineering: Heavy Construction Plant (SCQF level 6)

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

In Outcome 1 candidates should learn the purpose of the complete range of large/heavy construction plant. They should know plant and equipment relevant to the local industry from the previous list. Candidates must know the layout of components, drives to sub-assemblies, working principles and operational adjustments.

In Outcome 2 candidates should demonstrate an understanding of starting, running in operational mode and stopping items of plant. They should inspect and report on the condition of two complete items of large/heavy plant. The candidate should complete the reports on items of plant designated by the lecturer, which demonstrates the candidate's ability to successfully inspect used equipment with faults and allow them to provide a written or oral report.

In Outcome 3 candidates should participate in the completion of tasks designated by the lecturer where the candidate's ability to successfully dismantle, assess need for repair, rectify and then reassemble the components of a used item of large/heavy construction plant. If the machine is not a tracklayer, candidates must inspect, dismantle, inspect, repair/adjust and test a track sub-assembly on another item of plant and allow them to provide a written or oral report. Repair of working plant should be undertaken where possible. The plant should then be tested and set up in accordance with the manufacturer's recommendations.

Manufacturer's time scales should be referenced although it is not expected candidates will achieve skilled service engineer times.

In reporting on the condition/serviceability in Outcome 2 or dismantling, repairing and testing in Outcome 3, special emphasis should be placed on the sub-assemblies not covered in other Land-based Engineering Units (ie engines or transmissions). Each sub-assembly, including the machine drives, chassis or frame, and the ***principle unique working components*** (ie on a 'backhoe loader' the boom, backacter and bucket) of large wheeled construction plant, candidates should identify potential sources of excess wear. Soil or material engaging components should be examined for wear and malfunction and systems including the control and operation systems but excluding steering, braking, fuel, hydraulic, engine, transmission and electrics, which are not unique to the machine and which are covered in detail in other Land-based Engineering units.

Health Safety and the Environment

As Outcomes 2 and 3 require candidates to practically service and repair large plant either onsite or in a workshop situation, it is strongly recommended that they are inducted into current legislation, regulations and safe working procedures and practices before starting practical work. A safe system of work should be established in line with the Health Safety and the Environment Unit guidelines while taking cognisance of the candidate's previous experience and abilities prior to the commencement of practical activities. The methods of disposal of waste materials produced during the servicing of land-based equipment should comply with current legislation and good practice.

Health safety and environmental issues associated with this Unit should be ***should be taught together with the subject topics and not separately*** in the Land-based Engineering Health Safety and the Environment Unit although assessment of health, safety and environmental issues associated with this

Unit should be cross matched and assessed in the Land-based Health Safety and the Environment Unit.

National Unit Specification: support notes (cont)

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OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Elements of the Core Skill component Using Information Technology at SCQF level 5 may be developed in Outcomes 2 and 3 where job card/report writing is specified. As modern large construction plant equipment has electronic machine control systems which require calibration and/or adjustment to ensure they perform within manufacturer's specifications, further development opportunities exist. Candidates may research and report on the plant types, their constructional features in Outcome 1, servicing requirements and the methods of decommissioning machinery in Outcomes 2 and 3.

Elements of *Communication* at SCQF level 5 may be developed in Outcome 2 and 3 where report/job card writing is specified. This may further be developed in these Outcomes when candidates investigate, apply techniques and communicate detailed written conclusions regarding overall condition of modern large construction plant equipment and their servicing and routine maintenance. They are required to produce and respond to detailed and complex written communication in Outcome 1, investigate and apply techniques and communicate detailed written conclusions about the servicing, routine maintenance and overall condition of large construction plant equipment.

Elements of *Numeracy* at SCQF level 4 may be developed in Outcome 3 where various aspects of equipment performance are determined during the final testing. Using Graphical Information at SCQF level 5 may be developed in Outcome 3 as candidates are given data and use this to practically set up equipment units they are servicing. Centres have opportunities to develop Numeracy skills through contextualised reference and support materials provided to the candidate.

Elements of the Core Skill of *Problem Solving* at SCQF level 5 of may be developed in Outcomes 2 and 3 particularly the Critical Thinking component where candidates are involved in analysing results and deciding the most economic use of resources to practically complete the repair and servicing of modern large construction plant equipment. Planning and Organising, will be developed in group practical tasks where the allocation of resources is organised to produce a plan for repairs in practical workshop activities when candidates are dismantling, assessing condition of large/heavy construction plant, re-assembling, setting up and testing equipment. Reviewing and Evaluating may also be developed in Outcomes 2 and 3 after candidates have completed their group practical tasks, as they could evaluate the effectiveness of the work plan, drawing conclusions and offer alternative solutions to complete the task.

Elements of *Working with Others* Core Skill at SCQF level 5 may be developed in Outcomes 2 and 3 during team working in practical situations where co-operatively with others, sharing service engineering workshop areas, tools and equipment are the norm when repairing large construction plant. This could then be discussed in terms of the nature and scope of team goals, roles and responsibilities. Although candidates have to demonstrate practical skills independently, formative group activities will enhance skills in working with others. Additionally in developing a repair plan and completing the routine maintenance of large construction plant equipment, candidates could be given constructive feedback to encourage the review and evaluation of their approaches to practical work including their contribution to team working

National Unit Specification: support notes (cont)

UNIT Land-based Engineering: Heavy Construction Plant (SCQF level 6)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

A single, holistic assessment paper of short answer and or restricted response questions may assess Unit knowledge in Outcome 1. Alternately assessment of individual parts of the Outcome could be carried out at appropriate points during Unit delivery. Candidate evidence must be in the form of performance and written and/or recorded oral evidence.

Formative assessment exercises involving candidates in workshop inspections and repair skills acquisition will play a particularly important role in building candidate knowledge, understanding, skills and confidence of Unit content. Candidates would be required to complete an appropriate written job card/inspection report document associated with Outcomes 2 and 3.

In assessing the condition/serviceability in Outcome 2 or the dismantling, repairing and testing in Outcome 3, special emphasis should be placed on the sub-assemblies not covered in other Land-based Engineering units (ie engines or transmissions). Each sub-assembly, including the machine drives, chassis or frame, and the ***principle unique working components*** (ie on a 'backhoe loader' the boom, backacter and bucket) of large wheeled construction plant, candidates should assess potential sources of excess wear. Soil or material engaging components should be assessed for wear and malfunction and systems including the control and operation systems but excluding steering, braking, fuel, hydraulic, engine, transmission and electrics, which are not unique to the machine and which are covered in detail in other Land-based Engineering units.

An observation checklist must be used to record the evidence of candidates having satisfied all the Performance Criteria in Outcomes 2 and 3.

Health safety and environmental issues associated with this Unit should be taught together with the subject topics. Assessment of health, safety and environmental issues associated with this Unit should be cross matched and assessed in the Health Safety and the Environment 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 communications 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).*

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**