

Scottish Qualifications Authority

Workplace Assessed Unit Specification

General information

Unit Number F8XP 04 **Publication date:** June 2010

Title Inspect, Service and Maintain Solar Photovoltaic Systems

GENERAL COMPETENCE FOR UNIT:

The aim of this Unit is to allow candidates to develop the knowledge and skills required to inspect, service and maintain solar photovoltaic systems. The Unit focuses upon grid connected systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations.

OUTCOMES

- 1 Identify and describe the requirements to inspect, service and maintain solar photovoltaic systems
- 2 Inspect, service and maintain solar photovoltaic systems

ACCESS STATEMENT:

Access to this Unit is subject to the following pre-requisites:

Candidates must be qualified in an appropriate Mechanical Engineering Services or Building Services Engineering discipline to SVQ level 3 or equivalent and must have achieved the units F8XJ 04: Working Principles, Installation Options and Regulatory Requirements for Micro-renewable Technologies, Water Harvesting and Recycling Technologies and F8XL 04: Install, Test, Commission and Handover Solar Photovoltaic Systems.

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Workplace Assessed Unit Specification

Statement of standards

UNIT NUMBER: F8XP 04

UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

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 the Scottish Qualifications Authority.

OUTCOME 1

Identify and describe the requirements to inspect, service and maintain solar photovoltaic systems.

PERFORMANCE CRITERIA

- (a) Identify the requirements for the routine service and maintenance of solar photovoltaic system installations
- (b) Describe how to diagnose faults in solar photovoltaic system installations
- (c) Describe how to rectify faults in solar photovoltaic systems

RANGE STATEMENT

- (a) State which documentation needs to be available to enable a routine service and maintenance inspection

Clarify typical routine service and maintenance requirements in relation to:

- ◆ visual inspection requirements
- ◆ cleaning of components
- ◆ safe condition testing
- ◆ functional testing
- ◆ performance testing
- ◆ adjustment of controls/components

(EVTS 5, Kn b,d)

State the recording and reporting requirements for routine maintenance work

(EVTS 5, Kn e)

- (b) State the information that needs to be available to enable fault diagnosis

(EVTS 6, Kn a)

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Statement of standards (cont)

UNIT NUMBER: F8XP 04

UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

Propose the work action and sequences required to diagnose the following faults:

- ◆ Loss of full collection capacity
- ◆ Loss of output from inverter
- ◆ Loss of a.c. supply circuit to inverter
- ◆ No output from d.c. circuit
- ◆ Broken or damaged solar module
- ◆ Cable failure within d.c. circuit

(EVTS 6, Kn e)

(c) Propose the work action and sequences required to rectify the following faults:

- ◆ Loss of full collection capacity
- ◆ Loss of output from inverter
- ◆ Loss of a.c. supply circuit to inverter
- ◆ No output from d.c. circuit
- ◆ Broken or damaged solar module
- ◆ Cable failure within d.c. circuit

(EVTS 7, Kn b, d)

EVIDENCE REQUIREMENTS

Written and/or oral evidence is required to demonstrate knowledge defined in the PCs and must be produced in controlled supervised, open book conditions. This may be done by a balance of multiple choice, short answer, restricted response and structured questions.

OUTCOME 2

Inspect, service and maintain solar photovoltaic systems.

PERFORMANCE CRITERIA

- (a) Undertake the routine service and maintenance of a solar photovoltaic system installation
- (b) Undertake fault diagnosis work on a solar photovoltaic system installations
- (c) Undertake fault rectification work on solar photovoltaic system installations

Workplace Assessed Unit Specification

Statement of standards (cont)

UNIT NUMBER: F8XP 04

UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

RANGE STATEMENT

(a) Obtain the relevant information required to enable the work

(No specific NOS reference)

Undertake, using safe systems of work, a visual service and maintenance inspection to include checks in relation to:

- ◆ compliance with manufacturer's installation instructions
- ◆ compliance with statutory regulations
- ◆ the condition of system components
- ◆ the correct positioning of system components
- ◆ the security of fixing of system components
- ◆ the provision of adequate ventilation of system components

(EVTS 5, Perf. 3,4,5)

Undertake using safe systems of work, routine servicing of relevant system components to include:

- ◆ cleaning of systems components
- ◆ checking/adjustment of system controls

(EVTS 8, Perf. 1,2)

Undertake, using safe systems of work, routine service and maintenance tests to include:

- ◆ tests required under statutory regulations
- ◆ tests to confirm the correct operation of system safety devices
- ◆ tests to confirm the correct operation of system controls
- ◆ checks/actions to confirm the optimum performance of the PV array(s)

(EVTS 8, Perf. 1,2)

Complete the relevant records

(EVTS 8, Perf. 3)

(b) Obtain the relevant information required to enable the work

(EVTS 6, Perf. 1)

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Statement of standards (cont)

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Diagnose using safe systems of work, the cause of a minimum of FOUR separate faults from the following list:

- ◆ Loss of full collection capacity
- ◆ Loss of output from inverter
- ◆ Loss of a.c. supply circuit to inverter
- ◆ No output from d.c. circuit
- ◆ Broken or damaged solar PV module
- ◆ Cable failure within d.c. circuit

(EVTS 6, Perf. 3)

Agree with the relevant person(s) fault rectification procedures for the faults identified

(EVTS 6, Perf. 4, 5)

(c)

Take relevant precautionary actions to prevent unauthorised use of the system prior to or during the fault rectification work

(EVTS 7, Perf. 3)

Take relevant precautionary actions to minimize the risk of injury to self or others during the fault rectification work

(EVTS 7, Perf. 3)

Rectify, using safe systems of work, a minimum of TWO separate faults from the following list:

- ◆ Loss of full collection capacity
- ◆ Loss of output from inverter
- ◆ Loss of a.c. supply circuit to inverter
- ◆ No output from d.c. circuit
- ◆ Broken or damaged solar module
- ◆ Cable failure within d.c. circuit

(EVTS 7, Perf. 1)

Undertake post-rectification tests in accordance with manufacturer's guidance, regulatory requirements and industry recognised procedures to confirm that the system is in a safe, functional and efficient condition.

(EVTS 7, Perf. 2)

Workplace Assessed Unit Specification

Statement of standards (cont)

UNIT NUMBER: F8XP 04

UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

EVIDENCE REQUIREMENTS

A practical assessment is required to demonstrate the candidate's ability to inspect service and maintain Solar Photovoltaic Systems. The Unit focuses upon grid connected systems that are within the scope of Engineering Recommendation G83/1 with an electrical output of up to 5 kilowatt peak (kWp) connected to both single and three-phase installations.

ASSESSMENT

In order to achieve this Unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

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Support notes

UNIT NUMBER: F8XP 04

UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

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.

LINKS TO NATIONAL OCCUPATIONAL STANDARDS

Please note: Whilst a number of Outcomes and Performance Criteria within this Unit will have some relevance to larger scale solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1, achievement of the Unit will not provide the full competence required to inspect service and maintain solar photovoltaic system installations that are within the scope of Engineering Recommendation G59/1.

Throughout the Unit and where appropriate we have identified where the evidence relates to the SummitSkills National Occupation Standards (NOS) for Environmental Technology Systems for example:

EVTS 1 Kn b relates to the NOS	
EVTS 1	Plan for Environmental Technology Systems, Equipment and Components
Kn b	Knowledge Criteria b
EVTS, Perf 1	
EVTS 2	Plan for Environmental Technology Systems, Equipment and Components
Perf 1	Performance Criteria 2

APPROACHES TO GENERATING EVIDENCE

Written and/or oral evidence is required to demonstrate knowledge defined in the PCs and must be produced in controlled supervised, open book conditions.

Assessment of performance shall be carried out using either:

- ◆ evidence sourced from the workplace; and/or
- ◆ through simulation

Use of simulation for the assessment of performance outcomes

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Support notes

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UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

As agreed with sector stakeholders, within the building services engineering sector footprint, simulation is only normally to be used as an assessment method for performance outcome assessment in:

- ◆ those extremely rare circumstances where candidate/learner is unable to access the required range of work circumstances and as a result the candidate/learner lacks evidence for completion of the Unit(s); or
- ◆ those circumstances where safety critical and/or technical critical aspects of performance need to be assessed.

SQA and Summitskills recognise that due to the evolving nature of environmental technologies and their integration into the sector, environmental technology system installation, service and maintenance work may not yet be a regular work activity for some sector businesses and as a result restricted or no access to the required range of work circumstances may be more commonplace than for the more established work activities within the sector footprint. In recognition of this SQA and Summitskills considers it appropriate for additional flexibility regarding the use of simulation to be available whilst environmental technology system installation, service and maintenance work becomes more established and commonplace within the sector. However, this flexibility is given on the basis that it will be withdrawn or reduced at an appropriate stage. In order to allow for an initial period of stability in the assessment of environmental technology units the first review of this flexibility will take place in December 2011.

The use of simulation in the assessment of performance outcomes for environmental technology units is either permissible OR mandatory.

Simulation is permitted for all units and all assessed outcomes until December 2011. This permission is subject to compliance with the requirement for realistic working environment to be used for the simulated activity.

Simulation **must** take place for key safety critical/technical critical aspects of the environmental technology units. The building services engineering industries cannot afford for the candidates to make mistakes within the workplace and so it is required that candidates, as appropriate, will demonstrate competence of those key safety critical activities and their technical competence in simulated conditions, and under direct assessor observation, as outlined by technology overleaf.

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Support notes

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UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

Technology	Mandatory simulation requirements
Solar Thermal	Commissioning of completed new installations
	All fault identification and rectification activities
Solar Photovoltaic	Installation of solar photovoltaic d.c. circuits and components
	Inspection and testing of the completed installation including both a.c and d.c circuits
	All fault identification and rectification activities
Heat Pumps	Commissioning of completed new installations
	All fault identification and rectification activities
Biomass	To be agreed at upon completion of the Units
Bio-liquids	To be agreed at upon completion of the Units
Water recycling	To be agreed at upon completion of the Units
Micro-wind	To be agreed at upon completion of the Units
Micro-hydro	To be agreed at upon completion of the Units

APPROACHES TO ASSESSMENT

In this Unit an appropriate instrument of assessment for outcome 1 could be a question paper consisting of a balance of multiple choice, short answer, restricted response and structured questions.

Assessment of underpinning knowledge shall be carried out under controlled supervised, open book conditions using:

- ◆ centre set, centre marked assessment instruments

SQA will ensure that robust quality assurance arrangements are in place for the assessment of underpinning knowledge.

Realistic working environments for simulated practical activities

SQA are required to ensure that approved centres have appropriately realistic working environments for simulated assessment activities. SQA does not wish to be fully prescriptive regarding the requirements of such facilities as this may restrict the ability of some delivering centres to meet SQA approval requirements. However, the following requirements must be met:

- ◆ installation, testing, commissioning, service and maintenance and fault rectification activities shall be assessed using full size systems that replicate installations in a real working environment;

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Support notes

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UNIT TITLE: Inspect, Service and Maintain Solar Photovoltaic Systems

- ◆ the use of mobile rigs and scaled models of system installations shall not be used for the assessment of installation, testing, commissioning, service and maintenance and fault rectification activities.

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

REFERENCES

- 1 For a fuller discussion on assessment issues, please refer to SQA's Guides to Assessment and Quality Assurance.
- 2 Procedures for special needs statements are set out in SQA's guide 'Guidance on Special Assessment Arrangements'. (AA0645/3).
- 3 For details of other SQA publications, please consult SQA's publications list. (FD037).