



National Unit Specification: general information

UNIT Engineering: Hazards, Protection Methods and Functional Safety
(SCQF level 6)

CODE F5KP 12

SUMMARY

This Unit can be delivered as part of a National Qualification Group Award but can be taken as a free-standing Unit.

This Unit is designed to enable candidates to develop knowledge and understanding of hazards, protection methods and functional safety in the process industries.

This Unit is suitable for candidates studying the subject for the first time and acts as a basis for progression to employment and/or further study.

This Unit is designed to develop knowledge and skills like flammable atmospheres and protection methods, permits to work and risk control, detecting hazardous conditions and functional safety of equipment under control.

OUTCOMES

- 1 Investigate a flammable atmosphere and methods of protection.
- 2 Explain the permit to work method of risk control.
- 3 Explain methods of detecting a hazardous condition.
- 4 Explain the functional safety of equipment under control.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- ◆ Standard Grade Mathematics — General/Credit Level
- ◆ Standard Grade Technological Studies/Science — General/Credit Level

Administrative Information

Superclass: XA

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National Unit Specification: general information (cont)

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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.

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

Communication (SCQF level 6)

Problem solving (SCQF level 6)

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

Investigate a flammable atmosphere and methods of protection.

Performance Criteria

- (a) Factors affecting the ignition of a flammable atmosphere are correctly explained.
- (b) The concept of intrinsic safety is correctly explained.
- (c) Methods of barrier protection are correctly used.

OUTCOME 2

Explain the permit to work method of risk control.

Performance Criteria

- (a) The structure of authorisation and documentation is correctly explained.
- (b) Working within the operational limits of the permit is correctly explained.
- (c) Correct personal protective equipment and its use are correctly explained.

OUTCOME 3

Explain methods of detecting a hazardous condition.

Performance Criteria

- (a) Methods of smoke detection are correctly explained.
- (b) Methods of flame detection are correctly explained.
- (c) Methods of oily mist detection are correctly explained.

OUTCOME 4

Explain the functional safety of equipment under control.

- (a) Risk and risk reduction are correctly evaluated.
- (b) Layers of protection are correctly explained.
- (c) Emergency shutdown (ESD) systems are correctly explained.

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 oral evidence and performance evidence is required which demonstrates that the candidate has achieved Outcome 1 to the standard specified in the Outcome and Performance Criteria. Evidence of a short report is required regarding the use of the barriers. An assessor observation checklist should record the correct set up and configuration of the barrier device and should last approximately 1 hour.

The evidence for Outcomes 2, Outcome 3 and Outcome 4 should be a combined assessment carried out under controlled, supervised conditions. The assessment will be closed-book and last approximately 1 hour and 30 minutes.

National Unit Specification: support notes

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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 is an optional Unit within the National Certificate in Measurement and Control Engineering but is also suitable for candidates wishing to study the Unit on a free-standing basis.

Outcome 1

- ◆ Fire Triangle
- ◆ Ignition energy
- ◆ Lean and rich mixtures
- ◆ Upper and lower ignition levels
- ◆ Ignition methods
- ◆ Oxygen enrichment
- ◆ Gas groupings and classification
- ◆ Dispersal of the hazardous material
- ◆ Gas ignition curves and intrinsic safety
- ◆ Zener barriers as used in measurement and control systems

Outcome 2

- ◆ Authorisation from plant supervisor to plant user
- ◆ Operational limits — working area, process conditions, equipment and test equipment authorised
- ◆ Personal protective equipment — complies with requirements of the job

Outcome 3

- ◆ Ionisation smoke detectors
- ◆ Optical smoke detectors
- ◆ Infra-red and ultra-violet flame detectors
- ◆ Light scattering methods for oily mist

National Unit Specification: support notes (cont)

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Outcome 4

- ◆ Risk = hazardous effect x probability
- ◆ Evaluation of hazardous effect
- ◆ Examples of industry hazards
- ◆ Evaluation of probability of failure on demand
- ◆ Risk reduction and the concept of as low as reasonably practicable (ALARP)
- ◆ Fatal accident rate
- ◆ Risk reduction factor
- ◆ Safety availability
- ◆ Probability of failure on demand
- ◆ Layers of protection
- ◆ Separation, diagnostics and diversity
- ◆ Logic solvers and ESDs

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT.

In this Unit the Outcomes should be delivered in order.

The use of ICT (Information and Communication Technology) should be used to support the delivery of this Unit. This could take the form of candidates researching different types of detectors, barriers and emergency shutdown controllers on the internet.

This Unit requires access to a measurement and control engineering laboratory with a range of barrier devices and emergency shutdown controllers. Demonstrations and laboratory exercises can be used to improve the candidates understanding of hazardous atmospheres, hazards, intrinsic safety protection and functional safety methods as applied in process measurement and control. This will help to relate theory to practice.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Although skills in *Communication* are not formally assessed candidates have to read and summarise complex technical information on hazardous conditions and various methods of detection and protection. They should be encouraged to undertake background reading where they evaluate a range of key information sources. Written reports produced for Outcome 1 should be technically accurate, formally expressed and to acceptable industry standards.

Aspects of the Core Skill of *Problem Solving*, that is, critical thinking, planning and organising, reviewing and evaluating, will be naturally developed in this Unit, which requires application of knowledge to a practical task. Candidates identify, investigate and explain significant factors affecting the ignition of a flammable atmosphere before safely using methods of barrier protection. Discussion and evaluation of the numerous issues involved in dealing with hazardous conditions would be particularly useful during formative work and would enhance oral communication skills in a work related context.

National Unit Specification: support notes (cont)

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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 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)*.

Achievement of this Unit requires the Evidence Requirements for each Outcome to be met.

A candidate who does not initially achieve the specified standard can have a further opportunity, attempting only the Outcomes not previously achieved.

Written and/or oral evidence and performance evidence is required which demonstrates that the candidate has achieved Outcome 1 to the standard specified in the Outcome and Performance Criteria. Performance evidence in the form of investigating and using two suitable barrier devices as used in an industrial measurement and control system. Evidence of a short report is required regarding the use of the barriers. An assessor observation checklist should record the correct set up and configuration of the barrier device and should last approximately 1 hour.

Outcomes 2, 3 and 4 should be assessed by a 1 hour 30 minute closed -book test consisting of a series of short answer, restricted response and structured questions.

CANDIDATES WITH DISABILITIES AND/OR ADDITIONAL SUPPORT NEEDS

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs (www.sqa.org.uk)*.