



Higher National Unit specification

General information for centres

Unit title: Process Measurement and System Monitoring

Unit code: F812 34

Unit purpose: The purpose of this Unit is to give candidates the knowledge and understanding of the measurement of process variables and system monitoring practices. The Unit will enable candidates to understand fundamental calibration procedures on process variable instrumentation. Candidates will also be enabled with the knowledge underpinning the maintenance of a process in the required steady state conditions, the assessment of the functionality of a given system and the requirements to carry out first-line maintenance on the system and instrumentation.

On completion of the Unit the candidate should be able to:

- 1 Explain the measurement of process variables
- 2 Investigate a Process Monitoring System

Credit points and level: 1HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the centre. However, candidates will find it beneficial to have some knowledge and understanding of the oil and gas process context in which this Unit appertains which may be evidenced by the possession of the following Unit:

F811 34: Petroleum Industry: Organisation, Products and Processes

Core Skills: There are opportunities to develop the Core Skills of *Communication* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: This Unit was developed as a mandatory Unit within the context of the HNC/HND award in Petroleum Process Technology, Operations and Control. If this Unit is delivered as part of a group award, it is recommended that it should be taught and assessed within the subject area of the group award to which it contributes.

General information for centres (cont)

Assessment: The assessment for Outcome 1 and Outcome 2 of this Unit may be assessed separately by one hour assessments or integrated into one end of Unit assessment lasting no more than two hours. The end of Unit assessment should be taken by candidates at one single assessment event. The assessment for Outcome 1 should be composed of a suitable balance of short answer, restricted response and/or structured questions. The assessment for Outcome 2 should be composed of a suitable balance of short answer, restricted response and/or structured questions, OR alternatively Outcome 2 may be assessed through the use an investigative practical assignment.

Assessment should be conducted under controlled, closed-book, supervised conditions. Where documentation is required for an assessment, this should be provided as part of the assessment information.

Candidates must achieve all of the minimum evidence specified for each outcome in order to pass the Unit.

Higher National Unit specification: statement of standards

Unit title: Process Measurement and System Monitoring

Unit code: F812 34

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Explain the measurement of process variables

Knowledge and/or Skills

- ◆ Process parameters: flow, pressure, level, temperature
- ◆ Process measurement instrumentation
- ◆ Calibration of instrumentation
- ◆ Routine fault finding of measurement instrumentation
- ◆ Routine maintenance of measurement instrumentation

Evidence Requirements

Evidence for the knowledge and/or skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome four out of five Knowledge and/or Skills should be sampled.

In order to ensure candidates will not be able to foresee the items which they will be questioned on, a different sample of four Knowledge and/or Skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four Knowledge and/or Skills. When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- ◆ Explain the importance of measuring flow, pressure, level and temperature in a Process System
- ◆ Explain the operation of an measurement instrument suitable to measure one of the above process parameters
- ◆ Briefly describe the calibration procedure for a measurement instrument
- ◆ Explain the fault finding techniques used with measurement instrumentation
- ◆ Explain the routine maintenance of measurement instrumentation

Higher National Unit specification: statement of standards (cont)

Unit title: Process Measurement and System Monitoring

Assessment Guidelines

Outcome 1 may be assessed separately or combined with the assessment for Outcome 2. The separate assessment for Outcome 1 should have a planned duration of no more than one hour.

Assessment for Outcome 1 should take the form of an appropriate balance of short answer question, restricted response and structured questions.

Assessment should be conducted under controlled, closed-book, supervised conditions. Where documentation is required for an assessment, this should be provided as part of the assessment information.

Outcome 2

Investigate a process monitoring system

Knowledge and/or Skills

- ◆ Steady state conditions for different process systems: how are these achieved?
- ◆ Types and causes of deviations from steady state conditions
- ◆ Relevant first-line actions to remedy deviations from steady state conditions
- ◆ Testing and sampling: interpretation of results; leaks and product quality
- ◆ System condition reporting

Evidence Requirements

Evidence for the Knowledge and/or Skills in this Outcome will be provided on a sample basis and be presented in response to specific questions. Each candidate will need to demonstrate that he/she can answer correctly questions based on a sample of the items shown above. In any assessment of this Outcome four out of five Knowledge and/or Skills should be sampled.

In order to ensure candidates will not be able to foresee the items which they will be questioned on, a different sample of four Knowledge and/or Skills is to be used each time the Outcome is assessed. Candidates must provide a satisfactory response to all four Knowledge and/or Skills. When sampling takes place a candidate response can be judged satisfactory where evidence provided is sufficient to meet the requirements of each item by showing that the candidate is able to:

- ◆ Explain what is meant by steady state conditions for two different process systems and how the steady state conditions are achieved.
- ◆ Explain two types of deviation from steady state conditions and the causes of them.
- ◆ Explain relevant first-line actions to remedy deviations from steady state conditions.
- ◆ Explain how testing and sampling can take place and how the results are interpreted to identify leaks and product quality.
- ◆ Explain how system condition monitoring can take place.

Higher National Unit specification: statement of standards (cont)

Unit title: Process Measurement and System Monitoring

Assessment Guidelines

Outcome 2 may be assessed separately or combined with the assessment for Outcome 1. The separate assessment for Outcome 2 should have a planned duration of no more than one hour.

The assessment for Outcome 2 should be composed of a suitable balance of short answer, restricted response and/or structured questions. Alternatively, Outcome 2 may be assessed through the use of investigative practical assignment. The report of the practical assignment should be of around 1,500 words.

Assessment should be conducted under controlled, closed book, supervised conditions. Where documentation is required for an assessment, this should be provided as part of the assessment information.

Administrative Information

Unit code: F812 34

Unit title: Process Measurement and System Monitoring

Superclass category: VE

Original date of publication: August 2009

Version: 01

History of changes:

| Version | Description of change | Date |
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Higher National Unit specification: support notes

Unit title: Process Measurement and System Monitoring

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 has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 Explain the measurement of process variables
- 2 Investigate a Process Monitoring System

The Unit is at SCQF level 7 and the Unit has been developed as part of the HNC/HND Petroleum Process Operations and Control Technology. However this does not preclude the use of this Unit in other awards where award designers feel it is appropriate.

In designing this Unit, the writer has identified the range of topics that they would expect to be covered by lecturers. The writer has also given recommendations as to how much time should be spent on each Outcome. This is done to help lecturers to decide what depth of treatment should be given to the topics attached to each Outcome.

A list of topics for each Outcome is given below.

The Knowledge and Skills of each Outcome could be supported by practical work where relevant.

Outcome 1 (20 hours)

Explain the measurement of process variables

- ◆ The importance of measuring flow, pressure, level and temperature in a Process System
 - Fiscal reasons (payment, tax etc)
 - Safety (correct quantities being mixed, overfilling/over pressure avoided etc)
 - Efficient operation of plant
- ◆ Process measurement instrumentation
 - Flow — Turbine meter, ultrasonic, orifice plate etc
 - Pressure — capacitive type DP cell, piezoresistive type pressure cell etc
 - level — Ultrasonic/radar type, displacer, hydrostatic measurement etc
 - Temperature — RTD, thermocouple, infra red etc
- ◆ Calibration of instrumentation
 - Use of plant standards
 - Checking test equipment is certified as in test
 - Recording of calibration results
- ◆ Routine fault finding of measurement instrumentation
 - Check instrument against local display/other instrument measuring same process parameter
 - Obvious damage to instrument/impulse lines/cables
 - Water ingress
 - Checking impulse lines are not blocked/frozen

Higher National Unit specification: support notes (cont)

Unit title: Process Measurement and System Monitoring

- ◆ Routine maintenance of measurement instrumentation
 - Calibration
 - Check instrument against local display/other instrument measuring same process parameter
 - Obvious damage to instrument/impulse lines/cables
 - Water ingress
 - Checking impulse lines are not blocked/frozen

Outcome 2 (20 hours)

Investigate a Process Monitoring System

- ◆ Explain what is meant by steady state conditions for two different process systems and how the steady state conditions are achieved
 - Temperature process — ensuring steady rate of change
 - Monitor temperature
 - Monitor input flow rate
 - Monitor output flow rate
 - Monitor heat source
 - level process - ensuring constant level
 - Monitor input flow rate
 - Monitor output flow rate
- ◆ Explain two types of deviation from steady state conditions and the causes of them
 - Rate of change errors
 - Process variable/set point deviation errors
 - Amplitude errors
- ◆ Relevant first-line actions to remedy deviations from steady state conditions
 - Check instruments show correct output
 - Check valves move for 25%, 50%, 75% and 100% input
 - Check other parts of plant are functioning correctly (plant wide problem)
 - Check process fluids/gasses are correct density/viscosity/temperature etc (in line analysers)
- ◆ Explain how testing and sampling can take place and how the results are interpreted to identify leaks and product quality
 - Use of in line analysers to take samples in real time
 - Monitoring input and output flow rates
 - Re-directing flow to measuring equipment (prover loops)
- ◆ Explain how system condition monitoring can take place
 - Vibration monitoring for pumps/compressors
 - Inlet and outlet pressure monitoring for pumps
 - Pressure measurement across filters to identify blockages
 - Setting of alarms for deviation/rate of change etc

Higher National Unit specification: support notes (cont)

Unit title: Process Measurement and System Monitoring

Guidance on the delivery and assessment of this Unit

This Unit is designed to enable candidates to gain knowledge and understanding of Process Measurement and System Monitoring. It was developed as a mandatory Unit within the context of the HNC/D award in Petroleum Process Technology, Operations and Control but may also serve as a stand-alone Unit.

The content of the Outcomes means that they should be delivered in order.

Candidates should have access to examples of measurement devices and to a suitable plant for demonstration purposes.

This Unit may be delivered on a full-time, block release, open or blending learning, part-time day or part-time evening basis at the discretion of the SQA approved delivery centre. Learning and teaching methods may include a combination of lectures, tutorials, group work, practical/laboratory assignments, computer-based simulations, case studies and industrial visits. The use of flexible learning through on-line materials and methodologies is encouraged wherever possible to supplement and support the learning that takes place in the delivery centre. It is also recommended that candidates are directed to undertake internet research where a rich amount of material can be found that is relevant to the content of this Unit to support their learning. Wherever appropriate, it is recommended that relevant practical learning activities are used to support the development of the knowledge and understanding requirements of this Unit. At every appropriate opportunity, it is recommended that the delivery of this Unit reflects on the health, safety and environmental implications relevant to the content and context of this Unit.

Details on approaches to assessment are given under Evidence Requirements and Assessment guidelines under each Outcome in the Higher National Unit specification: Statement of Standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

Outcomes 1 and 2 may be assessed separately as one hour assessments or combined in one assessment event of no more than two hours. Where a practical assignment is used to assess Outcome 2, this may be a laboratory exercise or a case study related to specific industrial applications which is conducted in association with an industrial partner.

Any assessment should be conducted under controlled, supervised conditions.

The single assessment should be carried out at the end of the delivery of the Unit. Individual assessments should be carried out at the end of the delivery of each Outcome.

It should be noted that the candidates must achieve all the minimum evidence specified for each Outcome in order to pass the Unit. Where sampling of Knowledge and Skills items is used for assessment, the sampling should be selected to meet the specific needs of the candidate cohort within the context of their current employment or progression goals.

Higher National Unit specification: support notes (cont)

Unit title: Process Measurement and System Monitoring

Opportunities for developing Core Skills

There may be opportunities to gather evidence toward the following Core Skills within this Unit, although there is no automatic certification of Core Skills or Core Skills components in this Unit:

| | |
|------------------------|--------------|
| <i>Communication</i> | SCQF level 6 |
| <i>Problem Solving</i> | SCQF level 6 |

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. With regard to assessment, planning would be required of the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessments were conducted under controlled, supervised conditions. Agreement would have to be made to ensure that a single assessment for the end test is delivered in a supervised environment under controlled conditions.

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

General information for candidates

Unit title: Process Measurement and System Monitoring

This Unit has been designed to allow you to develop knowledge, understanding and skills associated with Process Measurement and System Monitoring systems used in industry to ensure safe and efficient operation of process plants.

The early part of the Unit deals with the measurement of process parameters, the reasons for measuring them and the devices used for measurement

The Unit will also enable you to gain an understanding of monitoring of a process plant with regards to ensuring the plant operates in a stable manner and how to deal with any deviations that may occur

This Unit can be delivered on a full-time, block release, open or blending learning, part-time day or part-time evening basis at the discretion of your SQA approved delivery centre. Learning and teaching methods may include lectures, tutorials, group work, and case studies. The use of flexible learning through on-line materials and methodologies may be used to supplement and support the learning that takes place in the delivery centre.

Within this Unit, you will also have opportunities to develop the transferable Core Skills of *Communication* and *Problem Solving* although these are not separately certificated.

Access to this is Unit fully inclusive and at the discretion of your SQA approved delivery centre. However, you may find it beneficial to have a prior knowledge of this area as provided by the SQA HN Unit *F811 34: Petroleum Industry: Organisation, Products and Processes*.

Formal assessment of this Unit may take the form of Outcomes 1 and 2 being assessed together that will last no longer than two hours. Assessments may be in the form of short answer, restricted response and structured questions.

Assessments will normally be conducted at the end of the delivery of each Outcome. Where assessments are combined, these may be conducted toward the end of the Unit. Assessment will be carried out under controlled, closed-book, supervised conditions.