



National Unit Specification: general information

UNIT Engineering Dimensional Control (SCQF level 5)

CODE F5W7 11

SUMMARY

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

This Unit has been designed to enable candidates to develop knowledge, understanding and skills in basic engineering measurement. During the delivery of the Unit candidates will develop the knowledge and understanding to state common measurement systems, units, datums and sources of measurement error and their minimisation. They will also learn to extract linear and angular dimensional information from drawings and use this information to measure and record the dimensions of engineering components.

This Unit is suitable for candidates training to be manufacturing, mechanical or multi-disciplinary engineering fitters or technicians but may also be delivered to candidates who are being introduced to engineering measurement for the first time.

OUTCOMES

- 1 State common measurement systems, units and datums used in engineering.
- 2 State common sources of engineering measurement error and their minimisation.
- 3 Extract dimensional information from drawings and use this information in measuring components and recording engineering measurements.

RECOMMENDED ENTRY

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

- ◆ the NQ Unit *Mathematics: Craft 1* (SCQF level 5)

Administrative Information

Superclass: XA

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CREDIT VALUE

1 credit at SCQF level 5 (6 SCQF credit points at SCQF level 5*).

**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 Skill:

Numeracy (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

State common measurement systems, units and datums used in engineering.

Performance Criteria

- (a) State correctly the measurement systems that are commonly used in engineering.
- (b) State correctly the units of measurement that are commonly used for linear and angular measurements.
- (c) Identify and record correctly appropriate datums for a range of engineering components.

OUTCOME 2

State common sources of engineering measurement error and their minimisation.

Performance Criteria

- (a) State correctly types of error that commonly occur when carrying out engineering measurements.
- (b) State correctly how common types of error can be minimised or removed.

OUTCOME 3

Extract dimensional information from drawings and use this information in measuring components and recording engineering measurements.

Performance Criteria

- (a) Extract linear and angular dimensions with tolerances correctly from engineering drawings.
- (b) Select correct measuring instruments appropriate to the measurement tasks.
- (c) Check correctly measuring instruments for calibration status.
- (d) Use measuring instruments correctly to perform measurement tasks.
- (e) Record measurements correctly on an inspection sheet and identify any non-conformance in measurements to drawing specifications.

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 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.

Outcomes 1 and 2 (Written and/or Recorded Oral Evidence)

Outcomes 1 and 2 may be assessed on an individual basis or the assessment of the two Outcomes may be combined. The total time for assessment(s) should not exceed 1 hour. Assessment(s) must be conducted under supervised, closed-book conditions in which candidates may use reference materials provided by the centre but are not allowed to bring their own notes, handouts, textbooks or other materials into the assessment.

With regard to Outcome 1:

- ◆ candidates must identify both the metric and imperial systems of measurement
- ◆ datums must include a surface, a line, a hole and a point

With regard to Outcome 2:

- ◆ sources of errors must include the following:
 - effects of dirt, grease
 - calibration error
 - effects of heat
 - instrument damage
 - incorrect application of the instrument (excessive force)
 - incorrect reading of the instrument (eg parallax error)

Outcome 3 (Performance and Written and/or Recorded Oral Evidence)

Assessment of Outcome 3 must be conducted under supervised, open-book conditions.

With regard to Outcome 3:

- ◆ candidates must check calibration records/documentation to ensure calibration of measuring equipment is within date.
- ◆ candidates must make measurements on two separate components. These measurements must include a minimum of six linear, three diameters and one angular measurement for each component. A minimum of two internal and two external diameters must be measured between the two components.
- ◆ during assessment(s) candidates must use the following measuring instruments and any ancillary equipment: rule, vernier caliper, external micrometer, depth micrometer and protractor.

National Unit Specification: statement of standards (cont)

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- ◆ all readings should be to an accuracy of one increment of the resolution of the measuring equipment used

An observation checklist(s) must be used to record evidence that candidates have undertaken all the measurement tasks in Outcome 3 correctly or not.

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 Unit has been developed for the National Qualification Group Award (NQGA) in Manufacturing Engineering at SCQF level 5, but may also be offered on a free-standing basis.

The Unit may be delivered using the metric or imperial system or a combination of both systems.

The aim of this Unit is to allow candidates to develop knowledge, understanding and skills in basic engineering measurement. On successful completion of the Unit candidates will have developed the knowledge and understanding to state common measurement systems, units, datums and sources of measurement error and their minimisation. They will also be able to extract linear and angular dimensional information from drawings and use this information to measure and record the dimensions of engineering components.

This Unit may prove very useful in supplementing and reinforcing knowledge, understanding and skills of dimensional control gained by candidates in other manufacturing Units already completed or being taken at the same time as the Unit (eg *Material Removal Principles: Milling* at SCQF level 5, *Material Removal Principles: Turning* at SCQF level 5, *Engineering Workshop Skills* at SCQF level 5 etc.)

While making and recording measurements candidates are likely to use the following measuring instruments:

- ◆ rules, internal and external calipers
- ◆ micrometers (external, internal, and depth)
- ◆ vernier calipers, vernier height gauges and vernier protractors
- ◆ angle, radius and ring gauges

Candidates may also use some of the following ancillary equipment while taking and recording measurements:

- ◆ surface plate
- ◆ angle plate
- ◆ bench centres
- ◆ straight edge

It is important throughout Unit delivery that candidates are introduced to good measurement practices including the correct use and care of measuring equipment and associated ancillary equipment. Candidates should be taught to appreciate that no measurement is absolute but contains some degree of error which may be acceptable, or not acceptable, in terms of a given drawing specification.

National Unit Specification: support notes (cont)

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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. The Unit may be delivered through a combination of lectures, practical demonstrations and practical tasks allowing candidates to develop their knowledge, understanding, skills and confidence in engineering measurement. This Unit may be delivered in an engineering workshop equipped with a wide range of measuring instruments and ancillary equipment.

Candidates should be exposed to a wide range of engineering drawings so that they can develop the knowledge and skills to interpret and extract dimensional information (including tolerance information) from such drawings. The candidates should also have access to a wide range of measuring equipment (and ancillary equipment) so that they can learn to identify, select and make accurate and consistent measurements.

Good wall charts involving measuring instruments and measuring techniques may also aid learning.

Videos, DVDs etc. on various aspects of engineering measurement may also support learning.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

As they undertake the Unit candidates perform a series of measurements before using and recording extracted dimensional information from engineering drawings. They interpret results, identifying and explaining any sources of error. *Numeracy* skills will be naturally enhanced, with the focus on practical interpretation and presentation. Formative activities in engineering contexts will encourage confidence through good practices including the correct use and care of measuring and associated ancillary equipment.

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 establishing component datums, making engineering measurements and in interpreting engineering measurement results.

Outcomes 1 and 2 may be assessed by an assessment paper comprising a balance of short answer and restricted response questions or objective questions (eg multi-choice questions) or a combination of both.

National Unit Specification: support notes (cont)

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Outcome 3 may be assessed by a series of practical exercises involving the measurement, recoding and interpretation of linear, diameter and angular dimensions taken from engineering components.

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