Title	**Demonstrate knowledge of, and use, coordinate measuring machine (CMM) technology**		
Level	**5**	**Credits**	**6**

Purpose	People credited with this unit standard are able to demonstrate knowledge of CMM technology; take measurements using a coordinate measuring machine; and produce and evaluate data.

Classification	Mechanical Engineering > Engineering - Measurement

Available grade	Achieved

Explanatory notes

1 References
Health and Safety in Employment Act 1992.
ISO 1101:2004, *Geometrical product specifications (GPS) – Geometrical tolerancing – Tolerances of form, orientation, location and run-out.*
ISO 10360-Parts 1-6, *Geometrical Product Specifications (GPS) – Acceptance and reverification tests for coordinate measuring machines (CMM)*, (2000/2001).

2 Range
Use of CMMs in this unit standard requires the measurement of various geometric tolerancing characteristics that may include but are not limited to – straightness, flatness of an internal plane, circularity, profile of any line, parallelism, perpendicularity, angularity, position, coaxiality, skew of two cylinder axes, distance between two bores, sphericity, and total run-out.
Evidence of measurement of at least four different characteristics on at least three simple three dimensional (3D) workpieces is required.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of CMM technology.

Evidence requirements

1.1 CMMs are compared in terms of types available and their basic operating principles.

Range may include but is not limited to – manual, computer numerical control (CNC) operated, horizontal arm, gantry, twin column, articulated arm, track mounted, software interface.

1.2 Machine components are described in terms of types available, and their function in the process of measuring.

Range may include but is not limited to – wrist, stylus, probe (laser, contact, touch trigger), workpiece table, slides (xyz), rotary table (C-axis), camera/video probe.

1.3 CMM technology is described in terms of advantages and disadvantages compared with conventional metrology equipment.

Range may include but is not limited to – time savings, cost, accuracy of measurements, elimination of multiplicity of expensive gauges, software complexities, training in use.

1.4 Terminology associated with CMM technology is explained.

Range reverse engineering, surface or profile digitising, qualification of styli.

Outcome 2

Take measurements using a coordinate measuring machine.

Range manual or CNC operated.

Evidence requirements

2.1 Volumetric accuracy of selected CMM is established prior to commencing task to ensure job specifications can be met.

2.2 Calibration certificate is viewed for the selected machine in advance of commencing the measurement task.

2.3 Coordinates and datum points are established, as appropriate, in accordance with machine type and job requirements.

2.4 Stylus selection is in accordance with the workpiece being measured and job requirements.

2.5 Measurement points are established relevant to the workpiece being measured, CMM type, and job requirements.

2.6 Workpiece is placed correctly within the machine to ensure ease of access to measurement points.

2.7 Measurements are confirmed through re-measurement at different points on the workpiece.

Outcome 3

Produce and evaluate data.

Evidence requirements

3.1 Raw data is produced in accordance with machine and software types.

Range hard copy and electronic formats.

3.2 Data evaluation compares measurements with computer aided design (CAD) model or specifications, establishes measurement uncertainty, and takes into account ambient temperature variations.

Planned review date	31 December 2016

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	23 May 1995	31 December 2011
Revision	2	14 April 1997	31 December 2011
Revision	3	5 January 1999	31 December 2011
Revision	4	23 May 2001	31 December 2011
Review	5	21 February 2005	31 December 2014
Review	6	17 November 2011	N/A

Consent and Moderation Requirements (CMR) reference	0013

This CMR can be accessed at http://www.nzqa.govt.nz/framework/search/index.do.

Please note
Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz on qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.