Title	**Demonstrate knowledge of basic trade calculations and units of measure for mechanical engineering trades**		
Level	**2**	**Credits**	**4**

Purpose	This unit standard is for use in the training and assessment for mechanical engineering trades and is one of a series of three unit standards for this purpose with 29398 and 29399. People credited with this unit standard are able to carry out basic arithmetic operations for mechanical engineering; demonstrate knowledge of SI base units of measure and SI derived quantities; carry out basic geometric calculations for mechanical engineering; demonstrate knowledge of and perform calculations for simple machines; and choose and apply appropriate engineering calculations to solve problems in simple engineering situations.

Classification	Mechanical Engineering > Engineering Core Skills

Available grade	Achieved

Explanatory notes

1 References
The International System of Units (SI), 8th edition, 2006, updated in 2014 (France: Bureau International des Poids et Mesures, 2006). Available at http://www.bipm.org/en/publications/si-brochure/

2 Definitions
Basic trigonometry – Pythagoras' Theorem, Interior Angles of Triangles Rule.
Quantities – properties ascribed to phenomena, bodies or substances that can be quantified; e.g. force, length, pressure.
Value of a quantity – the quantitative expression of a particular quantity, expressed as a numerical value with unit; e.g. 1.7m, 1700mm, 0.75 kPa, 30lb/in^2

3 Assessment information
For assessments, formulae and conversion factors shall be supplied, and use of calculators is permitted.
Assessments must reflect mechanical engineering applications.

Outcomes and evidence requirements

Outcome 1

Carry out basic arithmetic operations for mechanical engineering.

Evidence requirements

1.1 The sequence of arithmetic operations is stated.

Range arithmetic operations – parenthesis, exponents, division, multiplication, addition, subtraction.

1.2 Mathematical problems are solved logically and sequentially using basic arithmetic operations.

Range arithmetic operations – addition, subtraction, multiplication, division of whole and decimal numbers, and square and square root of whole numbers.

1.3 Fractions are converted to decimals and percentages, and vice versa.

1.4 Area and volume problems are solved logically and sequentially.

Range area problems involving – square, rectangle, triangle, circle.
volume problems involving – cube, rectangular prism, triangular prism, cylinder.

1.5 Quantity values expressed in imperial units are converted to metric and vice versa.

Range conversions between – ft and mm, in and mm, in and μm, lb and Kg, lb/in2 and Pa, degrees F and degrees C.

1.6 The perimeter of shapes is calculated.

Range shapes – square, rectangle, circle, triangle.

Outcome 2

Demonstrate knowledge of SI base units and SI derived quantities.

Range SI base units – metre, kilogram, second.

Evidence requirements

2.1 Relationship between SI prefixes is established by re-stating quantity values for SI base units using different SI prefixes.

Range SI prefixes – mega, kilo, milli, micro.

2.2 Relationship between SI base units and derived quantities is established using quantity equations.

Range SI derived quantities - speed, acceleration, torque, work, power, pressure.
For example, speed = distance / time expressed as m/s.

Outcome 3

Demonstrate knowledge of and perform geometric calculations.

Evidence requirements

3.1 Pythagoras' Theorem is stated.

3.2 Lengths and angles are calculated in right-angle triangles using Pythagoras' Theorem and Interior Angles of Triangles Rule.

Range evidence is required of a minimum of two calculations of length using Pythagoras' Theorem and two calculations of angles using Interior Angles of Triangles Rule.

3.3 Practical applications for Pythagoras' Theorem are described in the context of mechanical engineering.

Range includes but is not limited to – laying and marking out perpendicular components, measuring diagonals to check constructions are square.

Outcome 4

Demonstrate knowledge of and perform calculations for simple machines.

Range simple machines – first, second and third order lever; wedge; screw; pulley; wheel and axle.

Evidence requirements

4.1 Simple machines are identified and listed.

4.2 Simple machines are explained in terms of how they are used in mechanical engineering.

Range evidence is required of five different simple machines.

4.3 Calculations involving length, force, work and power are performed for simple machines and are expressed and manipulated as equations.

Range formula containing three symbols or numbers. May include but not limited to power = work / time, torque = force x distance, force = mass x acceleration; evidence of five different calculations is required.

Outcome 5

Choose and apply appropriate engineering calculations to solve problems in simple engineering situations.

Evidence requirements

5.1 Appropriate engineering calculations are chosen and applied to solve problems in simple engineering situations.

Range engineering calculations may include – basic arithmetic operations, SI base units and SI derived quantities, Pythagoras' Theorem and Interior Angles of Triangles rule, and simple machines; evidence is required of a minimum of three problems each combining a minimum of two engineering calculations.

Planned review date	31 December 2020

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	18 February 2016	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 at qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.