

## Apply principles of vibration and acoustics to mechanical engineering systems

**Level** 6

**Credits** 10

**Purpose** People credited with this unit standard are able to: analyse mechanical engineering systems and components in terms of vibration and acoustic principles; apply principles of vibration and acoustics in the design of mechanical engineering systems and components; and identify causes of problems associated with vibration and acoustics and specify remedial action.

**Subfield** Mechanical Engineering

**Domain** Applied Principles of Mechanical Engineering

**Status** Registered

**Status date** 27 October 2005

**Date version published** 19 March 2010

**Planned review date** 31 December 2015

**Entry information** Open.

**Accreditation** Evaluation of documentation and visit by NZQA and industry.

**Standard setting body (SSB)** Competenz

**Accreditation and Moderation Action Plan (AMAP) reference** 0013

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

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### Special notes

- 1 The credit value of this unit standard has been calculated on the basis that people seeking credit have previously acquired competence in the manipulation of logarithms, the transposition of formulae, the manipulation of equations, and the use of trigonometric functions; and have previously acquired understanding of fundamental concepts of physics (mass, length, and time) and their derived units, including pressure, force, gravitational effect, velocity, acceleration, and energy.

- 2 Evidence of the elements of this unit standard must be presented across the following contexts:
- principles – simple harmonic motion, deflection, whirling, wave motion, elasticity, natural frequency, resonance, isolation, damping, ergonomics;
  - systems – oscillating, rotational, and linear systems. Examples are vibrating conveyors, drive shafts, fans, reciprocating machinery;
  - components – beams, shafts, rotors, vibrating tables, rotating weights, magnetic vibrators, acoustic attenuators, shock absorbers, resilient mounts, seismic restraints.
- 3 The following apply to the performance of all elements of this unit standard:
- all measurements are to be expressed in Systeme International (SI) units, and, where required, converted from Imperial units into SI units;
  - all activities must comply with: any policies, procedures, and requirements of the organisations involved; the ethical codes and standards of relevant professional bodies; and any relevant legislative and/or regulatory requirements, which may include but are not limited to the Health and Safety in Employment Act 1992, Resource Management Act 1991, Fair Trading Act 1986, Consumer Guarantees Act 1993, and their subsequent and delegated legislation.

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## Elements and performance criteria

### Element 1

Analyse mechanical engineering systems and components in terms of vibration and acoustic principles.

### Performance criteria

- 1.1 Explanation of the principles of vibration and acoustics establishes their relevance to the control and use of noise and vibration in mechanical engineering contexts.
- 1.2 The properties of mechanical engineering systems and components are calculated, and formulae are selected, to meet the requirements of specific mechanical engineering situations.
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|-------|---|
| Range | properties – natural frequency, resonance, elasticity, deflection, stress, sound intensity, sound power, sound pressure, transmissibility, absorption, mass, moment of inertia, energy, force, velocity and acceleration;<br>formulae – whirling, dynamic deflection, transmissibility, absorption, vibration, static deflection, isolation, damping. |
|-------|---|
- 1.3 Explanation of the operation of components establishes their function in the control and use of machine vibration, and the control of noise levels generated by mechanical equipment.

- 1.4 The selection of instruments for measuring vibration and sound matches the instruments' performance characteristics and the operational requirements of specific mechanical engineering situations.

Range instruments – sound pressure level meters, accelerometers.

## Element 2

Apply principles of vibration and acoustics in the design of mechanical engineering systems and components.

Range systems – new and existing;  
design – for control of machine vibration, the use of machine vibration, the control of noise levels generated by mechanical equipment.

### Performance criteria

- 2.1 Designed systems and components conform with regulatory requirements for noise and vibration levels and deflection, and meet end user requirements for fitness for purpose and cost-effectiveness.
- 2.2 Design methodology used conforms with established engineering practice relevant to the systems being designed.
- 2.3 Selected resilient mounts, attenuators, and seismic restraints match user requirements for isolation efficiency.
- 2.4 Components are identified using terminology that meets the requirements of users.

## Element 3

Identify causes of problems associated with vibration and acoustics and specify remedial action.

Range problems – machine noise, machine vibration;  
evidence is required for one example of each.

### Performance criteria

- 3.1 Measuring instruments are used in accordance with established engineering practice and manufacturers' instructions, recommendations, and specifications.
- 3.2 Collation and analysis of data establish the nature of the problem as being associated with vibration and acoustics.
- Range data – measurements, maintenance records, operational reports.
- 3.3 Probable root causes of vibration and noise are identified in terms of excitation forces, natural frequency, and resonance.

3.4 Remedial actions specified restore operational integrity.

Range altering operating parameters, re-balancing, sound proofing, structural and/or acoustic isolation.

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**Please note**

Providers must be accredited by NZQA, or an inter-institutional body with delegated authority for quality assurance, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be accredited by NZQA before they can register credits from assessment against unit standards.

Accredited providers and Industry Training Organisations assessing against unit standards must engage with the moderation system that applies to those standards.

Accreditation requirements and an outline of the moderation system that applies to this standard are outlined in the Accreditation and Moderation Action Plan (AMAP). The AMAP 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.

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**Comments on this unit standard**

Please contact Competenz [info@competenz.org.nz](mailto:info@competenz.org.nz) if you wish to suggest changes to the content of this unit standard.