Australian Government

Department of Education, Employment and Workplace Relations

MEM234004A Design for engineering-related noise and vibration mitigation

Release: 1

MEM234004A Design for engineering-related noise and vibration mitigation

Modification History

New unit

Unit Descriptor

This unit of competency covers the design of noise and vibration mitigation systems for product, plant and equipment to ensure satisfactory operation, safety and comfort of people using, or in the proximity of the product, plant and equipment.

Application of the Unit

This unit applies to the design of products, plant and equipment across all forms of manufacturing and engineering. Design activities may also include reverse engineering, design rectification or modifications of an existing design. The unit includes the selection and use of appropriate measuring and monitoring equipment, modelling and calculations, and incorporation of noise and vibration mitigation techniques into designs.

This unit does not cover structural or civil engineering-related noise mitigation techniques, such as the design of noise barriers and anechoic chambers.

Prior experience in application of scientific principles, mathematics, measurement and evaluation of noise and vibration, computer software and file handling is required.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.	Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

1	Clarify the design brief and specifications for noise and vibration mitigation	1.1	Establish features of product, plant or equipment design specification likely to generate noise and vibration
		1.2	Confirm technical, commercial and environmental parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess occupational health and safety (OHS), regulatory, sustainability or environmental regulations and issues relevant to noise and vibration mitigation design task
		1.5	Confirm design brief, including budget and schedule, and provide preliminary advice on feasibility
2	Evaluate design analysis and prepare concept proposals	2.1	Appraise initial qualitative and quantitative analysis of the design task using appropriate equipment and techniques
		2.2	Carry out required modelling and calculations using appropriate software and validation techniques
		2.3	Generate a range of noise and vibration mitigation solutions to the design brief
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements
		2.5	Determine, social and sustainability implications of solutions
		2.6	Present concept proposals to client

3	Design for noise and vibration mitigation	3.1	Evaluate concept proposals with client
		3.2	Ensure that design solution is optimised with respect to the noise and vibration mitigation design task
		3.3	Finalise noise and vibration mitigation design, including ensuring preparation of all required documentation, drawings, specifications and instructions
		3.4	Consult with client and stakeholders to obtain sign-off on design
		3.5	Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required skills include:

- interpreting features of plant and equipment and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- designing noise and vibration mitigation solutions
- assessing features of plant and equipment designs that generate or decrease noise and vibration
- assessing a brief or contract specifications and the limits and constraints they impose on the ability to achieve noise and vibration mitigation in a design
- determining OHS, regulatory and risk management requirements
- selecting appropriate noise measurement and testing equipment and techniques
- selecting appropriate vibration measurement and testing techniques
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- communicating, negotiating and reviewing with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design
- investigating faults in existing designs and arriving at solutions

Required knowledge

Required knowledge includes:

- common sources of noise and vibration in plant and equipment
- features of plant or equipment in relation to noise and vibration mitigation
- feasibility and evaluation methods and design criteria
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- noise and vibration modeling and calculation techniques
- current options and trends in performance analysis, modelling and simulation software, including underpinning program techniques, including software validation
- physiological effects of noise and vibration
- risk factors for vibration and the human body
- industrial health and safety – audiometric testing
- noise and vibration concepts, such as vibration, noise, transmission of noise and vibration, and harmonic excitation

- sources of noise generation in plant and equipment
- noise mitigation, such as hearing protection, insulation, enclosures, fans and ducts
- sources of vibrations in plant and equipment
- vibration mitigation and shock control measures
- options for noise reduction in machine design (rotor bearing positioning)
- statistical energy analysis (SEA)
- techniques for:
  - continuous improvement
  - problem solving and decision making
  - root cause analysis (RCA) or failure mode and effects analysis (FMEA) or design review based on failure mode (DRBFM), and Pareto analysis

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

Critical aspects for assessment and evidence required to demonstrate competency in this unit	Assessors must be satisfied that the candidate can competently and consistently: • design noise and vibration mitigation solution • interpret features of plant and equipment and parameters to the brief or contract • advise client based on discipline knowledge and OHS and regulatory standards • research sustainability implications and current industrial design techniques • determine OHS, regulatory and risk management requirements • select, calibrate and set up equipment • investigate and measure • model and calculate using appropriate software and validation techniques • generate and evaluate a range of solutions for feasibility against design criteria • communicate, negotiate and review with stakeholders and client throughout process to obtain agreement on proposal and sign-off on design.
Context of and specific resources for assessment	• This unit may be assessed on the job, off the job, or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.
Method of assessment	• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package. • Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge. • Assessment methods must be by direct observation of tasks and

	include questioning on underpinning knowledge to ensure its correct interpretation and application. • Assessment may be applied under project-related conditions (real or simulated) and require evidence of process. • Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances. • Assessment may be in conjunction with assessment of other units of competency where required.

Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

Parameters to the design brief	The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include: • determination of the degree of innovation and creativity expected by the client • design process limits and budgets • product cost limits and budgets • performance specifications • equipment availability, capacities and restrictions • specified administrative, communication and approval procedures • other special features and limits in the design brief
OHS, regulatory, sustainability and environmental issues	OHS, regulatory, sustainability and environmental issues may include: • OHS Acts and regulations • relevant standards • industry codes of practice • risk assessments • registration requirements • safe work practices • minimising ecological and environmental footprint of process, plant and product • maximising economic benefit of process plant and product to the organisation and the community • minimising the negative OHS impact on employees, community and customer • state and territory regulatory requirements
Initial qualitative and	Initial qualitative and quantitative analysis may include:

quantitative analysis	• a hazard and risk analysis related to existing or proposed plant or equipment • routine noise and vibration monitoring data or investigative measurements
Equipment and techniques	Equipment and techniques may include: • data required related to test requirements • spectrum analysis or simple noise measurement of linear sound pressure levels • microphones and preamplifiers • specialist applications requiring supplementary transducers to locate source of noise • noise meters, such as hand-held, a-weighted, noise dose and precision options • recording techniques and equipment for various environments and sound characteristics • calibration • electrodynamics exciter • sinusoidal and random excitation • sub and super harmonics • force testing and structural response • simulated and real environment testing of shock • calibration
Range of noise and vibration mitigation solutions	Range of noise and vibration mitigation solutions may include: • controlling the source • controlling the transmission path • controlling the receiver • changing the operating condition of plant and machinery • vibration isolation • active vibration control
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task
Client	Client may be: • internal or external to the designer’s organisation

Unit Sector(s)

Engineering practice

Custom Content Section

Not applicable.