



Australian Government

MEM234006 Evaluate and select thermodynamic systems or subsystems

Release: 1

MEM234006 Evaluate and select thermodynamic systems or subsystems

Modification History

Release 1. Supersedes and is equivalent to MEM234006A Evaluate and select thermodynamic systems or subsystems.

Application

This unit of competency defines the skills and knowledge required to evaluate the performance and efficiency of thermodynamic plant and equipment and select systems to meet specifications. It includes the use of thermodynamic principles, including the law of entropy and the second law of thermodynamics, as applied to gas cycles and vapour cycles, flow-through nozzles and blade passages, impulse and reaction stages of turbines. It includes generation and transfer of heat energy using solid, liquid and gas mediums and application of software.

The client may be internal or external to the designer's organisation.

It is suitable for Principal Technical Officers and people in equivalent positions working with heat transfer, air conditioning, solar, geo-thermal and other power generation applications involving thermal energy transfer.

Individuals completing this work either already have or are developing skills and experience in scientific principles, evaluation of thermodynamic system components, mathematics and computer techniques.

No licensing, legislative or certification requirements apply to this unit at the time of publication.

Pre-requisite Unit

Nil

Competency Field

Engineering science

Elements and Performance Criteria

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
1. Clarify the specifications required	1.1 Establish features of plant and equipment and thermodynamic performance and efficiency parameters

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
for thermodynamic system	1.2 Confirm technical, commercial and environmental parameters of specifications 1.3 Determine stakeholders to be consulted in evaluation and selection process 1.4 Assess work health and safety (WHS), regulatory, sustainability or environmental regulations and issues relevant to the evaluation and selection task 1.5 Confirm selection requirements, including budget and schedule, and provide preliminary advice on feasibility
2. Evaluate thermodynamic system options and prepare concept proposals	2.1 Appraise initial qualitative and quantitative analysis of the evaluation and efficiency task 2.2 Carry out required modelling and calculations using appropriate software and validation techniques 2.3 Generate thermodynamic system solutions in response to selection requirements, including choice of equipment, layout, fluid source and delivery 2.4 Check feasibility and evaluate solutions against selection requirements, ensuring conformity to standards and codes, technical, economic and WHS requirements 2.5 Determine social and sustainability implications of solutions 2.6 Present concept proposals to client
3. Select thermodynamic system	3.1 Evaluate concept proposals with client and select preferred solution 3.2 Finalise selection, including equipment, layout, fluid source and delivery, and other features desired by client 3.3 Ensure preparation of all required documentation, drawings, specifications and instructions 3.4 Consult with client and stakeholders to obtain sign-off on selection 3.5 Monitor installation and commissioning with stakeholders and make any necessary adjustments to design

Foundation Skills

This section describes those language, literacy, numeracy and employment skills that are essential to performance.

Foundation skills essential to performance are explicit in the performance criteria of this unit of competency.

Range of Conditions

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This field allows for different work environments and conditions that may affect performance. Essential operating conditions that may be present (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) are included.

Parameters of the selection requirements include:	- determination of the degree of innovation and creativity expected by the client - selection process and product cost limits and budgets - performance and efficiency specifications - equipment availability, capacities and restrictions - specified administrative, communication and approval procedures - other special features and limits in the requirements.
WHS, regulatory requirements, codes of practice and enterprise procedures include:	- WHS acts, regulations and relevant standards - codes of practice from Australian and overseas engineering and technical associations and societies - risk assessments - registration requirements - safe work practices - state and territory regulatory requirements.
Initial qualitative and quantitative analysis includes:	- a hazard and risk analysis related to existing or proposed plant or equipment - routine noise and vibration monitoring data or investigative measurements.
Appropriate software and validation techniques include:	- performance analysis and modelling - the use of finite element analysis (FEA) and numerical methods within object-oriented modelling techniques - comparison of traditional solutions for simple thermodynamic system performance problems with software solutions to the same problems - review of previously implemented system performance challenges which were completed using the software.
Sustainability includes:	- meeting all regulatory requirements - conforming to all industry covenants, protocols and best practice guides - 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 WHS impact on employees, community and customer.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM234006A Evaluate and select thermodynamic systems or subsystems.

Links

Companion Volume Implementation Guides are available on VETNet -

<https://vetnet.gov.au/Pages/TrainingDocs.aspx?q=b7050d37-5fd0-4740-8f7d-3b7a49c10bb2>

Assessment Requirements for MEM234006 Evaluate and select thermodynamic systems or subsystems

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Performance Evidence

Evidence required to demonstrate competence in this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include:

- interpreting features of plant and equipment and parameters of specifications
- advising client based on discipline knowledge and work health and safety (WHS) and regulatory standards
- researching sustainability implications and current thermodynamic system design techniques
- determining WHS, regulatory and risk management requirements
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating solutions for feasibility against selection requirements on at least two occasions
- evaluating and selecting the most appropriate thermodynamic solution on at least two occasions
- communicating, negotiating and reviewing with stakeholders and client throughout the process to obtain agreement on proposal and sign-off on selection
- documenting evaluation and selection with drawings, specifications and instructions.

Note: Where a volume and/or frequency is not specified, demonstration must be provided at least once.

Knowledge Evidence

Evidence required to demonstrate the required knowledge for this unit must be relevant to and satisfy the requirements of the elements and performance criteria and include knowledge of:

- typical documentation, drawings, specifications and instructions required in thermodynamic system selection processes
- WHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- current options and trends in design, performance analysis, and modelling and simulation software relevant to thermodynamic systems, including underpinning program techniques and software validation techniques
- concepts of thermodynamics, properties of substances, conservation of mass and energy principles

- sustainability considerations
- law of entropy and the second law of thermodynamics
- second law analysis of thermodynamic systems
- actual and ideal gas cycles and vapour cycles
- impulse and reaction stages of turbines
- theory of heat transfer including conduction, convection, and radiation through different materials and geometric shapes
- heat flow solutions achieved by analytical, electrical analogy, graphical, numerical, failure effects analysis (FEA) and graphical software solution techniques.
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Assessment Conditions

- Assessors must:
 - have vocational competency in designing hydrodynamic pumping systems at least to the level being assessed with relevant industry knowledge and experience
 - satisfy the assessor requirements in the *Standards for Registered Training Organisations 2015 or its replacement* and comply with the *National Vocational Education and Training Regulator Act 2011*, its replacement or equivalent legislation covering VET regulation in a non-referring state/territory as the case requires.
- Where possible assessment must occur in operational workplace situations. Where this is not possible or where personal safety or environmental damage are limiting factors, assessment must occur in a sufficiently rigorous simulated environment that reflects realistic operational workplace conditions that cover all aspects of workplace performance, including environment, task skills, task management skills, contingency management skills and job role environment skills.
- Conditions for assessment must include access to all tools, equipment, materials and documentation required including relevant workplace procedures, product and manufacturing specifications.
- Assessment processes and techniques must be appropriate to the language, literacy and numeracy requirements of the work being performed and the needs of the candidate.

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