



Australian Government

MEM23114 Evaluate thermodynamic systems and components

Release: 1

MEM23114 Evaluate thermodynamic systems and components

Modification History

Release 1. Supersedes and is equivalent to MEM23114A Evaluate thermodynamic systems and components.

Application

This unit of competency defines the skills and knowledge required to evaluate thermodynamic systems and components including heat exchangers, heat engines, refrigeration, air conditioners and air compressors.

The evaluation can be undertaken as part of a design or system selection process or to assess system condition, sustainability or efficiency. It is suitable for people working as technicians or system designers and draftspersons, and for those pursuing careers and qualifications in engineering or related disciplines.

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

Pre-requisite Unit

MEM23004 Apply technical mathematics

MEM23006 Apply fluid and thermodynamics principles in engineering

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. Determine scope of thermodynamic system	1.1 Determine thermodynamic system and system components to be evaluated 1.2 Determine stakeholders to be consulted on the evaluation 1.3 Confirm that appropriate support, including technical and professional assistance, is available 1.4 Determine work health and safety (WHS) and regulatory requirements, risk management and organisational procedures 1.5 Investigate sustainability implications of thermodynamic

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	applications
2. Identify principles and techniques required for evaluation of thermodynamic system and components	2.1 Review features and functions of thermodynamic system and components 2.2 Determine thermodynamic principles and techniques required to evaluate system and select and optimise components 2.3 Determine appropriate analysis techniques, software and software validation techniques
3. Evaluate thermodynamic applications and components	3.1 Assess the performance of heat transfer devices 3.2 Assess heat engine performance 3.3 Assess combustion processes 3.4 Assess steam processes 3.5 Assess refrigeration and air conditioning processes 3.6 Assess air compression processes
4. Report results	4.1 Record outcomes of evaluation 4.2 Provide documentation including calculations, component and system layouts, and functional and thermodynamic cycle diagrams

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

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.

Sustainability includes:	- meeting all regulatory requirements - conforming to all industry covenants, protocols and best practice guides
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	• 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.
Appropriate licensed technical and professional assistance includes:	• technical support and advice relating to elements which have intrinsic dangers • professional support for technologies.
WHS, regulatory requirements and organisational procedures include:	• WHS acts, regulations and relevant standards • codes of practice from Australian and overseas engineering and technical associations and societies • risk assessments • safe work practices • state and territory regulatory requirements applying to electrical work.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23114A Evaluate thermodynamic systems and components.

Links

Companion Volume implementation guides are found in VETNet -

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

Assessment Requirements for MEM23114 Evaluate thermodynamic systems and components

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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:

- determining parameters and context of evaluation task
- determining work health and safety (WHS), regulatory requirements, risk management and organisational procedures
- identifying features, functions and components of thermodynamic dynamic systems and components
- investigating and reviewing sustainability implications, features and functions of thermodynamic systems and components on at least two occasions
- evaluating components and systems to determine safety, efficiency and fitness for purpose
- evaluating combustion, steam, air compression and refrigeration and air conditioning processes
- determining system performance and heat transfer on at least two occasions
- reporting and documenting processes and results of evaluation including calculations, component and system layouts, functional diagrams and thermodynamic cycle diagrams.

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

Knowledge Evidence

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

- WHS and regulatory requirements, codes of practice, standards and risk management requirements
- thermodynamic systems and components
- availability of professional and technical assistance
- current options and trends in performance analysis software including underpinning program techniques and software validation techniques
- descriptions of thermodynamic devices and systems including boilers, turbines, refrigerators, gas-turbines and rockets
- concepts related to thermodynamics including:
 - properties, process and state

- mass, conservation of mass, specific volume and density, force, weight, pressure and temperature
- systems, cycles and steady state
- energy forms
- effects of heating of solids and liquids
- heat transfer, conduction, convection and radiation including related laws and calculations
- typical thermodynamic devices and engines, and thermal cycles
- closed and open systems including:
 - non-flow, internal energy
 - flow systems, mass and volumetric flow and continuity of flow
- steady flow and enthalpy, turbines, compressors, boilers and heat exchanger applications
- zeroth and first laws in detail and second law (conceptual)
- gas laws and characteristics
- gas compression effects, measurements and calculations
- compressor types and characteristics of heat engines, including types, cycles, performance and efficiency fuels and combustion steam plant and processes for steam generation, heat transfer and power production, including steam saturation steam tables
- air conditioning, refrigeration and heat pumping plant and processes
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Assessment Conditions

- Assessors must:
 - have vocational competency in evaluating thermodynamic systems and components 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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