



Australian Government

MEM23006 Apply fluid and thermodynamics principles in engineering

Release: 1

MEM23006 Apply fluid and thermodynamics principles in engineering

Modification History

Release 1. Supersedes and is equivalent to MEM23006A Apply fluid and thermodynamics principles in engineering.

Application

This unit of competency defines the skills and knowledge required to apply fluid and thermodynamic principles to engineering applications. It includes fluid systems and components, forces on floating and submerged bodies, turbine and pumping systems, and jet forces on blades and plates.

This unit applies to fluid and thermodynamic devices and systems used in industry and is suitable for people working as technicians in engineering or related fields using hydrostatic, hydrodynamic, fluid power or heating, ventilation and air conditioning (HVAC) equipment and 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

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 fluid or thermodynamic application	1.1 Determine compliance requirements of work health and safety (WHS) and regulatory requirements, codes of practice, standards, risk assessment and registration 1.2 Review sustainability implications of fluid and thermodynamic tasks 1.3 Assess fluid, thermodynamic and vacuum principles, skills and techniques required by tasks 1.4 Review functions and features of fluid, thermodynamic and vacuum devices, machines and systems

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	1.5 Assess software techniques needed for analysis and graphics required by the task
2. Interpret fluid or thermodynamic system design for effective performance	2.1 Determine the energy cost for running boilers, heat engines, compressors or turbines over a billing period 2.2 Determine the efficiency of conversion of energy source to electrical, fluid, thermal or mechanical power 2.3 Determine the sustainability of the processes
3. Recommend fluid or thermodynamic system components	3.1 Select components for thermal and fluid systems ensuring compatible materials, pressure, temperature and flow capacity and appropriate performance 3.2 Determine pumping system power requirements to provide for raising fluid, adequate flow rate and specified system losses 3.3 Specify components and prove or test the performance requirements of specified system 3.4 Seek required technical and professional assistance or clarification of design information
4. Report results	4.1 Ensure clear and logical process of specification development and compatibility of units in calculations 4.2 Record results of investigation, evaluation and application

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.

System designs for	fluid
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industrial applications include one or more of the following:	• thermodynamic • vacuum.
Fluid and thermodynamic tasks include:	• energy costs, efficiency and sustainability assessment of running boilers, heat engines, compressors or turbines • fluid and thermal system component selection • pumping and turbine system power evaluation • evaluating vacuum system components and performance requirements.
Properties and units common to fluids and thermodynamics include:	• mass, weight and force • volume, density, specific volume and relative density • pressure (absolute and gauge), and atmospheric pressure variation • temperature (Celsius, Kelvin and others) • viscosity and surface tension • vapour pressure of a liquid (saturation vapour pressure) • temperature and pressure effects on properties • international system of units (SI) • fundamental dimensions and units • derived dimensions and units • enthalpy.
Static and hydrodynamic devices or systems include:	• floating and submerged bodies • turbine and pumping systems • stationary or moving plates or blades • vacuum systems.
Thermodynamic devices or systems include:	• heat transfer devices • compressors • boilers • turbines • heat exchangers • heat engines • refrigerators • heat pumps.
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 enterprise procedures include:	• WHS acts and regulations • relevant standards • codes of practice • risk assessments • registration requirements • safe work practices • state and territory regulatory requirements.
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Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23006A Apply fluid and thermodynamics principles in engineering

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 MEM23006 Apply fluid and thermodynamics principles in engineering

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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:

- reviewing sustainability implications, functions and features of fluid, thermodynamic and vacuum devices, machines and systems
- interpreting system designs for industrial applications
- selecting components for specified technical performance on at least two occasions
- calculating energy use in fluid, thermodynamic and vacuum system
- assessing and applying fluid, thermodynamic and vacuum principles and software skills and techniques to engineering tasks on at least two occasions
- reporting and documenting results of investigation, evaluation and application, calculations, diagrams, programs and files in accordance with procedures.

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:

- fluid mechanics and thermodynamics and their applications
- analytical, graphical, semi-graphical and software assisted techniques for applications for fluid and thermodynamic principles in engineering
- energy and sustainability concepts relevant to fluid and thermodynamic applications
- principles of turbines and heat engines
- static and hydrodynamic devices or systems
- thermodynamic devices or systems
- basic properties and concepts common to fluids and thermodynamics including:
 - atoms, molecules, inter-molecular forces, molecular motion, states of matter, solids, liquids, gases, basic properties and units
 - ideal or perfect gases and liquids
 - definitions
- energy types and concepts including:
 - potential energy, kinetic energy and internal energy
 - chemical energy = energy content of a fuel

- work, constant and variable force, relationship to pressure and volume changes
- sensible heat and specific heat capacity (C_p and C_v)
- phase change, latent heat, enthalpy and enthalpy diagram
- heat transfer processes
- concepts and properties of gases
- energy transfer in closed and open systems including:
 - definition of a closed system
 - non-flow energy equation definition of an open system
 - mass and volume flow rate and the continuity equation
- fluid mechanics, system components, statics, dynamics and power
- vacuum technology including:
 - definition of vacuum
 - states of matter
 - purposes of vacuums
 - degrees of vacuum
- methods of lowering pressure including:
 - displacement or transfer of gas
 - sorption or condensation
- barometric pressure including:
 - inverted mercury tube
 - variation of atmospheric pressure with altitude
- quantity of gas including mole, Avogadro's number and molar mass
- types of vacuum pumps for evacuating volumes
- description of typical vacuum vessels, features and functions
- applications of vacuum technology in industry
- when to seek licensed technical and professional assistance.
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Assessment Conditions

- Assessors must:
 - have vocational competency in applying fluid and thermodynamics principles in engineering 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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