



Australian Government

MEM23129 Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration

Release: 1

MEM23129 Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration

Modification History

Release 1. Supersedes and is equivalent to MEM23129A Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration.

Application

This unit of competency defines the skills and knowledge required to evaluate thermal load estimates for heating, ventilation, air conditioning and refrigeration (HVACR) systems in multiple zone commercial/industrial buildings and engineering facilities, commercial refrigeration systems and related installations. It includes consideration of work health and safety (WHS) and related safety compliance requirements, and system evaluation, including the use of software and validation, thermodynamic concepts and laws.

It is suitable for people working as technicians, system designers, draftspersons, maintainers, 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

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 evaluation of thermal loads and HVACR systems	1.1 Establish type, location and scope of HVACR systems, building and refrigerated enclosures from plans, data sheets, specifications and site inspections 1.2 Identify stakeholders to be consulted during evaluation 1.3 Establish software and software techniques required for evaluation analysis 1.4 Determine WHS, regulatory and environmental requirements

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	relevant to evaluation 1.5 Investigate sustainability implications of HVACR and building management systems
2. Prepare for thermal loads and HVACR systems evaluation	2.1 Review thermal load analysis techniques for multiple zone commercial or industrial buildings, including use of tabulations and computer software 2.2 Identify sources of heat gains for building 2.3 Review room sensible and latent heat, including peak values 2.4 Review thermal load analysis techniques for commercial refrigeration systems, including use of tabulations and computer software 2.5 Identify heat load sources for refrigerated enclosures or zones 2.6 Determine tools, equipment, testing devices and materials required for evaluation 2.7 Determine required measurements and measurement techniques 2.8 Calibrate, set up, and test measurement equipment and procedures 2.9 Identify appropriate analysis techniques, analysis and simulation software and software validation techniques
3. Evaluate thermal loads and HVACR systems	3.1 Evaluate thermal load for a commercial refrigeration system 3.2 Evaluate thermal load for a multiple zone commercial or industrial building 3.3 Evaluate the effects of internal and external parameter changes on refrigeration system performance 3.4 Evaluate thermal performance of a building and options for design improvements 3.5 Evaluate building to identify and mitigate high thermal loads 3.6 Evaluate performance of refrigeration and air conditioning system against specifications and determine optimum operational settings 3.7 Evaluate equipment size, including coil and air handling unit capacities for constant and variable volume systems, and central refrigeration and boiler capacities 3.8 Evaluate and validate software for refrigeration and building thermal performance analysis and system simulation

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
4. Report results	4.1 Record results of evaluation, including recommendations for design and system setting optimisation 4.2 Provide documentation that includes written and visual details of processes and results

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 • 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 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 and 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.
Building heat gains are affected by:	- external, internal and system heat gains - U values and infiltration rates for various wall and roof constructions - sun, Azimuth and altitude angles, and overall shade factors for various windows.
Commercial refrigeration cabinets include:	- defrost and heating systems - temperature control - air flows (refrigeration) - air screens (refrigerated and ambient store) - types of evaporation - lighting.
Miscellaneous heat includes:	- electrical load - human load - defrost load - machinery load.
Relevant documentation includes:	- thermal load audits - calculations for heating and cooling loads - building and refrigeration layouts - heating and cooling system and component arrangements - system improvement diagrams.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM23129A Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration.

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 MEM23129 Evaluate thermal loads for heating, ventilation, air conditioning and refrigeration

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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 heating, ventilation, air conditioning and refrigeration (HVACR) system parameters from plans, specifications and site inspections
- investigating sustainability implications of HVACR systems
- identifying relevant thermodynamic principles and techniques for HVACR system thermal load evaluations
- reviewing features and functions of HVACR systems and components
- testing and measuring HVACR systems and component performance parameters on at least two occasions
- evaluating system and component performance with tabulated and software generated data on at least two occasions
- applying and validating software for analysis and simulation
- reporting and documenting processes, results and recommendations.

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:

- work health and safety (WHS) and regulatory requirements, codes of practice, standards, risk management and registration requirements
- sources of professional and technical assistance
- current options and trends in performance analysis software, including underpinning program techniques
- thermal load measuring equipment and test apparatus
- sustainability implications of HVACR systems, including consideration of energy sources and energy efficiency
- thermodynamic principles required by thermal loading analysis and HVACR management systems
- thermodynamic concepts related to HVACR including:
 - properties, process and state

- mass, conservation of mass, specific volume and density, specific volume, relative density, force, weight, pressure, temperature, Zeroth law, absolute scales and International System of Units (SI) units
- systems, cycles and steady state
- energy forms
- effects of heating of solids and liquids
- heat transfer, conduction, convection and radiation including:
 - property tables for conductivity, convection and radiation coefficients
 - Fourier law of conduction and conductivity of materials
 - convection including:
 - mechanism of convection
 - convection heat transfer coefficient and factors affecting the coefficient
 - fluid flow characteristics including geometry of convection surfaces, natural and forced convection and flow regime
 - units, kinematic viscosity and dynamic viscosity
 - convective heat transfer coefficients for conduit and annular flow and hydraulic diameter
 - heat exchangers including types, efficiency and measurements
 - radiators including:
 - emission, absorption and reflection (properties and measurements)
 - Wien's displacement law
 - Kirchhoff's law
 - solar energy, heating and power generation
 - radiant energy on surfaces
 - variations including Azimuth and zenith angles, path length, cloud cover and water vapour, and shade factors for windows
 - combined heat transfer
 - conduction plus convection, including heat exchangers using air and water as transfer mediums
 - conduction, convection and radiation (qualitative)
 - cooling fins
 - heat flow, electrical analogy, graphical solution techniques and qualitative understanding of numerical methods
- vapour-compression refrigeration including:
 - vapour-compression cycle for refrigeration
 - system components, including throttling valves and capillary tubes as throttling devices
 - performance criteria for refrigeration system evaluation
 - types of refrigerants
 - refrigerant properties and pH diagrams including:
 - ideal vapour compression cycle on the pH diagram

- energy balance and heat transfers in compressor, evaporator and condenser
- variation of actual cycles from the ideal
- vapour-compression cycle with suction superheating, liquid sub-cooling and pressure drop in system components
- mechanical components of vapour compression including refrigeration and HVAC systems
- refrigeration enclosures, cabinets, cold rooms and freezer rooms
- factors affecting refrigeration heat transfer
- building thermal performance survey procedures
- factors affecting building heat gains
- standard thermal values in relation to a commercial or industrial building
- equipment size for constant and variable volume systems and central refrigeration and boiler capacities
- thermal properties of buildings and building materials
- people loads, occupant comfort and safety factors
- cost implications of air conditioning and heating designs
- heat loads and thermal lag.
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Assessment Conditions

- Assessors must:
 - have vocational competency in evaluating thermal loads for heating, ventilation, air conditioning and refrigeration 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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