



Australian Government

MEM234018 Design heating, ventilation, air conditioning and refrigeration control systems

Release: 1

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Modification History

Release 1. Supersedes and is equivalent to MEM234018A Design heating, ventilation, air conditioning and refrigeration control systems.

Application

This unit of competency defines the skills and knowledge required to design heating, ventilation, air conditioning and refrigeration (HVACR) control and energy management systems and includes the selection of control system elements to suit HVACR environmental and hardware control requirements and development of an energy management plan.

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

It applies to the design of control systems and energy management plans across all forms of manufacturing and engineering and design activities can also include reverse engineering, and design rectification or modifications of an existing design. It is suitable for refrigeration system contractors, HVACR consultants, designers and senior maintenance personnel.

Individuals completing this work either already have or are developing skills and experience in the evaluation of HVACR control systems, hydronic and refrigeration systems and thermal loads, electrical principles, controller programming and computing.

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 design brief and specifications for HVACR control system	1.1 Establish required features and performance parameters of HVACR control system 1.2 Confirm technical, commercial and environmental parameters of the brief or contract

Elements	Performance Criteria
<i>Elements describe the essential outcomes.</i>	<i>Performance criteria describe the performance needed to demonstrate achievement of the element.</i>
	1.3 Determine stakeholders to be consulted in design process 1.4 Assess work health and safety (WHS), regulatory, sustainability or environmental issues relevant to the 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 2.2 Carry out required detailed modelling and calculations using appropriate software and validation techniques appropriate to system environment 2.3 Generate solutions that respond to the design brief for an HVACR control system 2.4 Develop an associated energy management plan for the design 2.5 Integrate building management systems (BMS) considerations into the design based on requirements of the brief 2.6 Check feasibility and evaluate solutions against design criteria, ensuring conformity to standards and codes, technical, economic and WHS requirements 2.7 Determine social and sustainability implications of solutions 2.8 Present concept proposals to client
3. Design HVACR control system	3.1 Evaluate concept proposals with client 3.2 Ensure that design solution is optimised with respect to the system specifications 3.3 Finalise selected design, including equipment, layout and fluid requirements 3.4 Ensure preparation of all required documentation, drawings, specifications and instructions 3.5 Consult with client and stakeholders to obtain sign-off on design 3.6 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

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.

HVACR control system includes:	• human machine interfaces (HMIs) • web servers, network topology and bus systems • protocols • system or network controllers • programmable logic controllers (PLCs) • terminal unit controllers for major plant components including boilers and HVACR central plant air handlers, chilled and hot water valves, air dampers, supply fans and lighting • analog and digital input/output (I/O) • remote control systems, including ethernet options.
Parameters of the brief or contract include:	• the design of new equipment or fault analysis, rectification or modification to an existing design • 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.
WHS, regulatory, sustainability or environmental issues include:	• WHS acts, regulations and 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 WHS impact on employees, community and customer

	state and territory regulatory requirements.
Environment includes one or more of the following:	- workplaces - food halls - restaurants - hotels - hospitals - domestic dwellings - industrial sites, factories, warehouses and cold storage areas - transport and refrigerated vehicles and trains.
Solutions include those that:	- satisfy the technical requirements of the design brief - are within budget - are able to be manufactured - meet any regulatory requirements - minimise environmental and sustainability impacts.
System specifications include:	- ducts and duct systems: - materials - supports - factory and field fabricated - sealants - layout and placements - capacity - zoning - heating and cooling loads - air flow and pressures - refrigerants - energy efficiency - air intake points - control equipment - monitoring equipment.
Energy management plan includes:	- information needed to make efficient and effective movement to improved energy management and reduce energy consumption which includes: - critical information - steps - resources - methods.
BMS includes one or more of the following:	- HVACR control systems - fire controls - security controls - lighting controls.

Unit Mapping Information

Release 1. Supersedes and is equivalent to MEM234018A Design heating, ventilation, air conditioning and refrigeration control systems.

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 MEM234018 Design heating, ventilation, air conditioning and refrigeration control systems

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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:

- establishing required features of heating, ventilation and refrigeration plant and equipment
- confirming parameters of the brief or contract and providing initial advice based on discipline knowledge, standards, work health and safety (WHS), regulatory and risk assessment requirements
- researching sustainability implications and current industrial design techniques
- investigating, measuring, modelling and calculating using appropriate software and validation techniques
- investigating faults in existing designs and proposing solutions
- innovating and creating solutions, incorporating systems thinking, continuous improvement and constraint and contingency management
- designing control systems and energy management plans on at least two occasions, using current design criteria and programming building control systems software
- applying safe working practices and procedures
- communicating, negotiating and reviewing with stakeholders and client throughout the process to obtain agreement on proposal and sign-off on design
- documenting design through the production of graphics, 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:

- contemporary engineering design methods
- heating, ventilation, air conditioning and refrigeration (HVACR) control systems
- brief or contract parameters
- energy management principles
- relevant engineering design methods

- design, research, modelling and computational methodologies applied to HVACR control systems
- design methods, research and investigations methods
- 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
- WHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- control system principles applied to HVACR systems
- types of control equipment
- system specifications
- system hardware requirements including industrial and commercial refrigeration systems, hydronic systems and automated controls
- HVACR load cycles
- principles of building management systems (BMS) and building management control system software
- energy options including unit tariffs, system and component consumption, benchmarks for energy costs and comparative tariffs of supply authorities
- interface principles for system components
- major system hardware component control and energy requirements
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators.

Assessment Conditions

- Assessors must:
 - have vocational competency in designing heating, ventilation, air conditioning and refrigeration control 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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