



Australian Government

Department of Education, Employment and Workplace Relations

MEM234018A Design heating, ventilation, air conditioning and refrigeration control systems

Release: 1

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Modification History

New unit

Unit Descriptor

This unit of competency covers the design of heating, ventilation, air conditioning and refrigeration (HVAC/R) control and energy management systems. It includes the selection of control system elements to suit HVAC/R environmental and hardware control requirements and development of an energy management plan.

Application of the Unit

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

Prior or concurrent experience in the evaluation of HVAC/R control systems, hydronic and refrigeration systems and thermal loads, electrical principles, controller programming and computing is required.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Not applicable.

Employability Skills Information

This unit contains employability skills.

Elements and Performance Criteria Pre-Content

Elements describe the essential outcomes of a unit of competency.

Performance criteria describe the performance needed to demonstrate achievement of the element. Where bold italicised text is used, further information is detailed in the required skills and knowledge section and the range statement. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

1	Clarify the design brief and specifications for HVAC/R control system	1.1	Establish required features and performance parameters of HVAC/R control system
		1.2	Confirm technical, commercial and environmental parameters to the brief or contract
		1.3	Determine stakeholders to be consulted in design process
		1.4	Assess occupational health and safety (OHS), 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 given environments
		2.3	Generate a range of solutions to the design brief for an HVAC/R control system and associated energy management plan
		2.4	Integrate building management systems (BMS) considerations into the design, where required
		2.5	Check feasibility and evaluate solutions against design criteria ensuring conformity to standards and codes, technical, economic and OHS requirements
		2.6	Determine social and sustainability implications of

- solutions
- 2.7 Present concept proposals to client
- 3 Design HVAC/R 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

Required Skills and Knowledge

This section describes the skills and knowledge required for this unit.

Required skills

Required knowledge includes:

- interpreting features of plant and equipment, and parameters to the brief or contract
- advising clients based on discipline knowledge and OHS and regulatory standards
- researching sustainability implications and current industrial design techniques
- investigating faults in existing designs and arriving at solutions
- determining OHS, regulatory and risk management requirements
- modelling and calculating using appropriate software and validation techniques
- generating and evaluating a range of solutions for feasibility against design criteria
- designing HVAC/R control system and energy management plans using current design methods
- programming building control systems software
- communicating, consulting, negotiating and reviewing with client, stakeholders, experts, licensed technical and professional services
- documenting design with drawings, specifications and instructions

Required knowledge

Required knowledge includes:

- contemporary engineering design methods
- HVAC/R control systems techniques
- energy management principles
- relevant engineering design methods
- design, research, modelling and computational methodologies applied the HVAC/R 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
- OHS and regulatory requirements, codes of practice, standards, risk minimisation and registration requirements
- control system principles applied to HVAC/R systems

- types of control equipment
- system hardware requirements, such as industrial and commercial refrigeration systems, hydronic systems and automated controls
- HVAC/R load cycles
- BMS principles
- energy options, such as unit tariffs, system and component consumption, benchmarks for energy costs and comparative tariffs of supply authorities
- interface principles for system components
- building management control system software
- major system hardware component control and energy requirements
- interface principles and techniques for electrical, electronic, pneumatic and hydraulic sensors and actuators

Evidence Guide

The evidence guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, range statement and the Assessment Guidelines for the Training Package.

<p>Critical aspects for assessment and evidence required to demonstrate competency in this unit</p>	<p>Assessors must be satisfied that the candidate can competently and consistently:</p> <ul style="list-style-type: none"> • design control system and energy management plans • apply safe working practices and procedures • conform to OHS, regulatory and environmental requirements, standards, codes of practice, risk management and organisational procedures • investigate and interpret brief and options • communicate, consult, negotiate and review with client, stakeholders, experts, and licensed technical and professional services • research current issues, sustainability implications, control system and energy management options, software and programming techniques • measure and investigate for initial proposals • model and calculate • use judgement and discretion • use appropriate software and validation techniques • innovate and create for a range of solutions incorporating systems thinking, continuous improvement and constraint and contingency management • evaluate solutions against design criteria • conform to OHS requirements • obtain sign-off on design • document and produce graphics and drawings, specifications and instructions.
<p>Context of and specific resources for assessment</p>	<ul style="list-style-type: none"> • This unit may be assessed on the job, off the job or a combination of both on and off the job. Where assessment occurs off the job, that is, the candidate is not in productive work, then a simulated working environment must be used where the range of conditions reflects realistic workplace situations. The competencies covered by this unit would be demonstrated by an individual working alone or as part of a team. • Where applicable, reasonable adjustment must be made to work environments and training situations to accommodate ethnicity, age, gender, demographics and disability. • Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical

	resources should include equipment modified for people with disabilities.
Method of assessment	<ul style="list-style-type: none">• Assessment must satisfy the endorsed Assessment Guidelines of the MEM05 Metal and Engineering Training Package.• Assessment methods must confirm consistency and accuracy of performance (over time and in a range of workplace relevant contexts) together with application of underpinning knowledge.• Assessment methods must be by direct observation of tasks and include questioning on underpinning knowledge to ensure its correct interpretation and application.• Assessment may be applied under project-related conditions (real or simulated) and require evidence of process.• Assessment must confirm a reasonable inference that competency is able not only to be satisfied under the particular circumstance, but is able to be transferred to other circumstances.• Assessment may be in conjunction with assessment of other units of competency where required.
Guidance information for assessment	Assessment processes and techniques must be culturally appropriate and appropriate to the language and literacy capacity of the candidate and the work being performed.

Range Statement

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Bold italicised wording, if used in the performance criteria, is detailed below. Essential operating conditions that may be present with training and assessment (depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts) may also be included.

<p>HVAC/R control system</p>	<p>System components may include:</p> <ul style="list-style-type: none"> • human machine interfaces • web servers, network topology and bus systems • protocols • system or network controllers • programmable logic controllers (PLCs) • terminal unit controllers for major plant components, such as boilers and HVAC/R 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
<p>Parameters to the brief or contract</p>	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design. Parameters to the design brief may include:</p> <ul style="list-style-type: none"> • 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
<p>OHS, regulatory, sustainability or environmental issues</p>	<p>OHS, regulatory, sustainability or environmental issues may include:</p> <ul style="list-style-type: none"> • OHS Acts and regulations • 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

	<ul style="list-style-type: none">• minimising the negative OHS impact on employees, community and customer• state and territory regulatory requirements
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<p>Given environments</p>	<p>Given environments may include:</p> <ul style="list-style-type: none"> • workplaces • food halls • restaurants • hotels • hospitals • domestic dwellings • industrial sites, factories, warehouses and cold storage areas • transport and refrigerated vehicles and trains
<p>Range of solutions</p>	<p>Range of solutions may include solutions that:</p> <ul style="list-style-type: none"> • 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
<p>Standards and codes</p>	<p>Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task</p>
<p>Client</p>	<p>Client may be:</p> <ul style="list-style-type: none"> • internal or external to the designer’s organisation
<p>System specifications</p>	<p>System specifications may include, but are not limited to:</p> <ul style="list-style-type: none"> • ducts and duct systems: <ul style="list-style-type: none"> • 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
<p>Energy management plan</p>	<p>An energy management plan is a planning document that acts as a single source for all the critical information, steps, resources and</p>

	methods you need to make efficient and effective movement to improved energy management and reduce energy consumption
BMS	BMS include: <ul style="list-style-type: none">• HVAC/R control systems and may also include fire, security and lighting controls

Unit Sector(s)

Engineering practice

Custom Content Section

Not applicable.