



Australian Government

Department of Education, Employment and Workplace Relations

MEM234015A Design hydronic heat exchanger systems

Release: 1

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Modification History

New unit

Unit Descriptor

This unit of competency covers the design of hydronic heat exchanger systems using steam or water as the heat transfer medium. It includes boilers for heat generation, cooling towers and chillers for heat dissipation.

Application of the Unit

This unit applies to the design of hydronic heat exchanger systems 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 hydronic system contractors, building heating, ventilation and air conditioning (HVAC) consultants, designers and maintenance personnel.

Prior experience in the evaluation of hydronic systems, application of heating, ventilation, air conditioning and refrigeration (HVAC/R) principles, mathematics and computer techniques 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 the hydronic heat exchanger system	1.1	Establish required features and performance parameters of a hydronic heat exchanger 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 a hydronic heat exchange system
		2.4	Check feasibility and evaluate solutions against design criteria ensuring conformity to OHS, air quality, environmental and sustainability requirements.
		2.5	Present concept proposals to client and select preferred solution

- 3 Design hydronic system
 - 3.1 Develop a hydronic system design
 - 3.2 Provide documentation, drawings, specifications and instructions
 - 3.3 Consult with client and stakeholders to obtain sign-off on design
 - 3.4 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 skills include:

- 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
- 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 hydronic heat exchange systems, including selection of boilers, pumps, cooling towers and chillers, as required using current design methods
- investigating faults in existing designs and arriving at solutions
- communicating, consulting, negotiating and reviewing with client and stakeholders
- documenting design with drawings, specifications and instructions

Required knowledge

Required knowledge includes:

- contemporary engineering design 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
- documenting design with drawings, specifications and instructions required
- OHS, regulatory and environmental requirements for work areas and refrigerated spaces, standards, codes of practice, risk management and organisational procedures related to HVAC/R design, installation, operation and maintenance
- concepts of thermodynamics, hydronics, properties of substances, conservation of mass and energy principles
- heat transfer (e.g. conduction, convection and radiation)
- heat exchangers
- water chillers
- pumping systems and cavitation
- practical pump installations and operation problems

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 hydronic systems • apply safe working practices and procedures • communicate, consult, negotiate and review with client and stakeholders • research and respond to current issues • measure and investigate site and system requirements • model and calculate • 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, environmental and sustainability requirements • obtain sign-off on design • document, 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.
<p>Method of assessment</p>	<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

	<p>include questioning on underpinning knowledge to ensure its correct interpretation and application.</p> <ul style="list-style-type: none">• 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.

Hydronic heating systems	Hydronic heating systems generally use a boiler to heat water which is then pumped through piping to panel radiators which are installed in each area requiring heating. Heat then transfers from the panel in each room by natural convection
Parameters to the design brief	<p>The design brief may include the design of new equipment or fault analysis, rectification or modification to an existing design.</p> <p>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
OHS, regulatory, sustainability and environmental issues	<p>OHS, regulatory, sustainability and 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 • minimising the negative OHS impact on employees, community and customer • state and territory regulatory requirements
Given environments	<p>Given environments may include:</p> <ul style="list-style-type: none"> • workplaces

	<ul style="list-style-type: none">• food halls• restaurants• hotels• hospitals• domestic dwellings• industrial sites, factories, warehouses and cold storage areas
Standards and codes	Standards and codes refer to all relevant Australian and international standards and codes applicable to a particular design task

Unit Sector(s)

Engineering practice

Custom Content Section

Not applicable.