



Australian Government

CPCPCM5013A Design complex (non-solar) heated water systems

Release 1

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Modification History

Changes to performance criteria, required skills and knowledge, range statement and critical aspects

Not equivalent to CPCPCM5003B

Unit Descriptor

This unit of competency specifies the outcomes required for the design and specification of complex (non-solar) heated water supply and distribution systems for residential, commercial and industrial applications. The unit includes circulating systems, fuel and energy loads and system selection.

Application of the Unit

This unit of competency supports development of skills and knowledge required for competent workplace performance in a consultancy or supervisory capacity in relation to plumbing services and hydraulics.

Licensing/Regulatory Information

In some jurisdictions, this unit of competency may form part of accreditation, licensing, legislative, regulatory or certification requirements.

Pre-Requisites

Nil

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

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|---|------------------------------------|-----|---|
| 1 | Evaluate design parameters. | 1.1 | <i>Scope of work</i> is established for heated water supply and distribution systems for wide span and high-rise building projects. |
| | | 1.2 | <i>Design requirements</i> , including the control of Legionella bacteria, are determined from relevant Australian standards, codes, plans, specifications and client brief. |
| | | 1.3 | <i>Cost-benefit analysis</i> is conducted comparing a range of pipe materials and system designs. |
| | | 1.4 | <i>Statutory and regulatory requirements</i> for the design of complex (non-solar) heated water supply and distribution systems are analysed and applied. |
| | | 1.5 | <i>Manufacturer requirements</i> and trade and technical manuals are interpreted. |
| | | 1.6 | Additional research, including a <i>desktop study</i> , is conducted. |
| | | 1.7 | <i>Performance requirements</i> are established, considering safety of system users or building occupants. |
| 2 | Plan and detail system components. | 2.1 | <i>Layout of pipework systems</i> and type and location of <i>fittings and valves</i> are planned. |
| | | 2.2 | <i>Thermostatic mixing, tempering</i> and control valves are detailed for a range of applications, and appropriate symbols are used. |
| | | 2.3 | <i>Circulating heated water supply systems</i> are designed and detailed. |
| | | 2.4 | <i>Heat trace systems</i> are designed and detailed. |
| | | 2.5 | Warm water systems are designed and detailed, including disinfection and bio-control measures. |
| | | 2.6 | <i>Calculations for sizing water heaters</i> are conducted and <i>methods for the control of expansion</i> are detailed. |
| | | 2.7 | Pipe sizes are calculated and <i>pipe supports</i> are designed for a range of applications. |

- 2.8 **Manifolding heated water units** are detailed for a range of **water heaters**, and **safe trays and overflows** are specified.
- 2.9 Approved **materials** and **jointing methods, insulation materials** and **installation requirements** for a range of water heaters and heated water systems are specified.
- 2.10 Allowance for expansion and contraction is provided.
- 2.11 Acoustic performance of the system is included in the plan.
- 3 Design and size systems.
- 3.1 Complex (non-solar) heated water supply and distribution systems are designed for a range of wide span and high-rise building applications.
- 3.2 **Circulating systems** are designed and detailed.
- 3.3 Complex (non-solar) heated water supply and distribution systems are designed and sized using computer software packages.
- 3.4 **Sustainability principles and concepts** are applied throughout the design process.
- 4 Prepare documentation
- 4.1 Client brief of the desired design is prepared.
- 4.2 **Plans** are prepared for a range of complex (non-solar) heated water supply and distribution systems.
- 4.3 **Specification** for a heated water supply and distribution system is prepared.
- 4.4 **Testing** and **commissioning schedule** is prepared.
- 4.5 **Operation and maintenance manual** is produced, including information on how to properly and safely maintain the system.

Required Skills and Knowledge

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

Required skills

- communication skills to:
 - confirm job specifications and client requirements
 - communicate with others to ensure safe and effective work practices
 - enable clear and direct communication, using questioning to identify and confirm requirements, share information, listen and understand
 - use language and concepts appropriate to cultural differences
 - use and interpret non-verbal communication, such as hand signals
- initiative and enterprise skills to:
 - develop creative and responsive approaches
 - identify and accurately report to appropriate personnel any faults in tools, equipment or materials
- literacy skills to:
 - prepare written documentation, including plans, specifications and schedules
 - produce an operation and maintenance manual
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - standards and manufacturer requirements and manuals
 - statutory and regulatory requirements
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of complex (non-solar) heated water systems
 - take initiative and make decisions
- problem-solving skills to analyse requirements, consider options and design an appropriate system
- technical skills to apply design concepts and principles
- teamwork skills to work with others to action tasks and relate to people from a range of cultural and ethnic backgrounds and with varying physical and mental abilities
- technology skills to:
 - access and understand site-specific instructions in a variety of media
 - use mobile communication technology

Required knowledge

- application of National Construction Code, relevant Australian standards, codes and

manufacturer specifications

- common terminology and definitions used in design of complex (non-solar) heated water systems
- installation methods and hazards identified in relation to devices and systems used according to relevant Australian standards, codes and standard operating procedures
- nature of materials used and effects of performance under various conditions
- work health and safety (WHS) requirements, including relevant statutory regulations, codes and standards

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.

Overview of assessment

This unit of competency could be assessed in the workplace or a close simulation of the workplace environment providing that simulated or project-based assessment techniques fully replicate plumbing and services workplace conditions, materials, activities, responsibilities and procedures.

It may be assessed on its own or as part of an integrated assessment activity involving effective performance and application of principles used to design complex (non-solar) heated water systems.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

A person who demonstrates competency in this unit must be able to provide evidence of the ability to:

- design, size and document the layout details, including a specification, for a high rise mixed development building to a minimum of 29 floors, inclusive of a basement to include fixtures on each floor level (fixtures are included in the basement) to include:
 - using two methods of providing a heated water system, one to be gas only and one to incorporate an alternative energy efficient heat source
- evaluate and document design parameters, including client, regulatory, manufacturer and relevant Australian standard and code requirements for a range of heated water supply and distribution systems
- evaluate health risks associated with heated water supplies
- plan and detail system components, including:
 - heat source
 - flue arrangements
 - flow and return systems
 - insulation requirements
 - manifolding systems
 - provision for expansion
 - temperature control device
- comply with WHS regulations applicable to

workplace operations

- apply organisational quality procedures and processes within context of designing complex heated water systems
- design and size a range of heated water supply and distribution systems
- design and size a range of circulating systems
- prepare plans for a range of heated water supply and distribution systems
- prepare specification for a heated water supply and distribution system
- prepare a testing and commissioning schedule
- prepare an operation and maintenance manual
- apply sustainability principles and concepts throughout to achieve a star rating under the Green Building Council of Australia rating scheme
- communicate with others to ensure safe and effective work site operations.

Context of and specific resources for assessment

This competency is to be assessed using standard and authorised work practices, safety requirements and environmental constraints.

Assessment of essential underpinning knowledge will usually be conducted in an off-site context.

Assessment is to comply with relevant regulatory or Australian standards' requirements.

Resource implications for assessment include:

- an induction procedure and requirement
- realistic tasks or simulated tasks covering the minimum task requirements
- relevant specifications and work instructions
- tools and equipment appropriate to applying safe work practices
- support materials appropriate to activity
- workplace instructions relating to safe work practices and addressing hazards and emergencies
- material safety data sheets
- research resources, including industry-related systems information.

Reasonable adjustments for people with disabilities must be made to assessment processes where required. This could include access to modified equipment and

other physical resources, and the provision of appropriate assessment support.

Method of assessment

Assessment methods must:

- satisfy the endorsed Assessment Guidelines of the Construction, Plumbing and Services Training Package
- include direct observation of tasks in real or simulated work conditions, with questioning to confirm the ability to consistently identify and correctly interpret the essential underpinning knowledge required for practical application
- reinforce the integration of employability skills with workplace tasks and job roles
- confirm that competency is verified and able to be transferred to other circumstances and environments.

Validity and sufficiency of evidence requires that:

- competency will need to be demonstrated over a period of time reflecting the scope of the role and the practical requirements of the workplace
- where the assessment is part of a structured learning experience the evidence collected must relate to a number of performances assessed at different points in time and separated by further learning and practice, with a decision on competency only taken at the point when the assessor has complete confidence in the person's demonstrated ability and applied knowledge
- all assessment that is part of a structured learning experience must include a combination of direct, indirect and supplementary evidence.

Assessment processes and techniques should as far as is practical take into account the language, literacy and numeracy capacity of the candidate in relation to the competency being assessed.

Supplementary evidence of competency may be obtained from relevant authenticated documentation from third parties, such as existing supervisors, team leaders or specialist training staff.

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.

Scope of work:

- must include interpretation of plans and specifications
- must include sizing and documenting layout of heated water supply and distribution systems for applications including residential, commercial, industrial and health
- may be for new projects or an existing structure being renovated, extended, restored or maintained.

Design requirements must include:

- architectural plans
- builder specifications
- fire rating of penetrations
- flue requirements
- owner requirements
- pipework identification
- specialist heated water use applications.

Cost-benefit analysis:

- compares the range of suitable materials and system choices available to enable cost-effective choices to be made without compromising the integrity of the project
- may include:
 - design styles
 - energy costs
 - expected design life
 - labour costs
 - material costs
 - safety factors
 - speed of installation
 - suitable materials
 - system choices.

Statutory and regulatory requirements must include:

- Acts and regulations
- National Construction Code

- relevant Australian standards and codes, including AS/NZS3500 National plumbing and drainage
- local government and health department requirements.

Manufacturer requirements may include:

- material specifications
- heater maintenance and servicing
- provision for heater pressure and temperature discharge
- pump tables
- sizing tables
- recommended specific fixings for pipework
- technical and trade manuals.

Desktop study may include collection and interpretation of data for design purposes from:

- architectural and building plans
- developer plans
- other documents, including:
 - applications
 - brochures
 - forms
 - policies
 - other reports as available.

Performance requirements must include:

- those established using relevant Australian standards, building codes and other relevant documents.

Layout of pipework systems may include:

- dead leg
- pressurised
- thermo convection
- circulating.

Fittings and valves may include:

- fittings:
 - bends
 - tees
 - unions
- valves:
 - backflow prevention
 - cold water expansion

- isolating
- non-return, including high pressure non-return
- pressure limiting
- pressure relief
- strainers
- temperature control.

Thermostatic mixing and tempering valves may include:

- bimetallic types
- wax capsule.

Circulating heated water supply system details may include:

- circulating pump specification
- dead leg minimisation
- flow and return pipework
- circulation
- pipe insulation
- thermal convection circulating.

Heat trace systems may include:

- installation requirements
- running costs
- serviceability.

Calculations for sizing water heaters may include:

- coefficient of expansion
- daily flows
- energy consumption
- heat losses
- mixed temperatures
- peak demand
- recovery times
- size and quantity of heated water required
- standby versus continual flow
- tariffs
- water expansion.

Methods for the control of expansion may include:

- U-bends
- coiled loop
- lyre bend
- offset bends
- proprietary expansion control devices.

Pipe support may include:

- anchors
- bracket spacing
- corrosion protection
- hanging brackets
- material requirements
- provision for expansion
- saddles
- wall and ceiling brackets.

Manifolding heated water units must include:

- balanced flow conditions and valves
- pressure relief requirements.

Water heaters:

- may include:
 - continuous flow
 - heat transfer
 - pressure storage systems
 - open vented storage systems
- heated source may include:
 - electricity
 - gas
 - heat pump
 - solar
 - solid fuel
 - waste heat.

Safe trays and overflows must include:

- design
- discharge
- materials
- sizes.

Materials may include:

- pipe materials as specified, including:
 - copper
 - composite
 - polymer
 - other approved materials
- flue materials, including stainless steel
- ancillary material, including:

- air relief valve
- heaters
- fittings and fixtures
- insulation
- pumps
- valves.

Jointing methods may include:

- brazing
- compression
- electrofusion welding
- flaring
- mechanical joints
- threading.

Insulation materials may include:

- fibre glass
- foam
- metal sheathing
- rock wool
- other approved materials.

Installation requirements must include:

- fire rating of penetrations
- level of workmanship
- manufacturer-recommended specific fixings
- pipe support
- provision for expansion
- serviceability and access.

Circulating systems may include:

- approved pressure pipes and fittings
- balancing valves
- circulating pump and controls
- isolating valves
- thermo cycle
- temperature gauge
- pump sizing to meet calculated flow conditions.

Sustainability principles and concepts:

- cover the current and future social, economic and environmental use of resources
- may include:
 - selecting appropriate material to ensure minimal

environmental impact

- efficient use of material
- efficient energy usage/capital outlay comparison
- selection of energy efficient water heater
- water efficiency
- consideration of the Green Building Council of Australia rating scheme.

Plans:

- may include:
 - axonometrics
 - cross-sections
 - details
 - elevations
 - isometrics
 - schematics
 - sections
- may be produced using:
 - computer generation
 - drawing equipment.

Specification may include:

- support
- jointing
- flow requirements
- manufacturer requirements
- materials
- residual pressures and temperature
- safety (WHS)
- specialised components
- testing
- valve selection
- water treatment
- workmanship.

Testing may include:

- air pressure
- defect inspection
- flue operation
- hydrostatic
- mains pressure
- performance

Commissioning schedule may include:

- quality assurance (QA) audit.
- balancing the system
- checking and flushing the system
- disinfection
- flow test
- flue operation
- leak check
- pressure test
- system certification
- system defects
- system functions as per design
- system purge
- temperature setting
- valve operation.

Operation and maintenance manual may include:

- as installed drawings
- results of commissioning test
- certification documentation
- heater details, settings and operations
- maintenance schedules
- manufacturer brochures and technical information
- valve function.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.