Australian Government

Department of Education, Employment and Workplace Relations

CPCPCM5003B Design complex (non-solar) heated water systems

Release: 1

CPCPCM5003B Design complex (non-solar) heated water systems

Modification History

Not Applicable

Unit Descriptor

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

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

Not Applicable

Pre-Requisites

Prerequisite units Nil

Employability Skills Information

Employability skills 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

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

ELEMENT	PERFORMANCE CRITERIA
	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.
4. Prepare documentation.	4.1. ***Plans*** are prepared for a range of complex (non-solar) heated water supply and distribution systems. 4.2. ***Specification*** for a heated water supply and distribution system is prepared. 4.3. ***Testing*** and ***commissioning schedule*** is prepared. 4.4. ***Operation and maintenance manual*** is produced.

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

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

Required skills

Required skills for this unit are:

- 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
  - 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
  - use language and concepts appropriate to cultural differences
  - use and interpret non-verbal communication, such as hand signals
- identifying and accurately reporting to appropriate personnel any faults in tools, equipment or materials
- innovation skills to develop creative and responsive approaches
- planning and organisational skills to:
  - research, collect, organise and understand information relating to the design of

REQUIRED SKILLS AND KNOWLEDGE

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, including the ability 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
- technological skills to:
  - access and understand site-specific instructions in a variety of media
  - use mobile communication technology.

Required knowledge

Required knowledge for this unit is:

- application of Australian and New Zealand standards 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 Australian and New Zealand standards and other codes or standard operating procedures
- nature of materials used and effects of performance under various conditions
- workplace safety requirements, including relevant statutory regulations, codes and standards.

Evidence Guide

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:

- evaluating and documenting design parameters, including client, regulatory, manufacturer and Australian and New Zealand standard requirements for a range of heated water supply and distribution systems
- planning and detailing system components, including:
  - tempering valves
  - manifolding systems
  - insulation requirements
  - flow and return systems
- complying with OHS regulations applicable to workplace operations
- applying organisational quality procedures and processes within context of designing complex heated water systems
- designing and sizing a range of heated water supply and distribution systems
- designing and sizing a range of circulating systems
- sound preparation of plans for a range of heated water supply and distribution systems
- sound preparation of a specification for a heated water supply and distribution system

EVIDENCE GUIDE

	• sound preparation of a testing and commissioning schedule • preparing an operation and maintenance manual • interactive communication 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 working 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

EVIDENCE GUIDE

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

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

RANGE STATEMENT

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:	• includes interpretation of plans and specifications • includes sizing and documenting layout of heated water supply and distribution systems for applications including residential, commercial and industrial • may be for new projects or an existing structure being renovated, extended, restored or maintained.
Design requirements may include:	• architectural specifications • builder specifications • owner requirements • specialist heated water use applications.
Cost-benefit analysis refers to comparison of a range of factors to enable cost-effective choices to be made without compromising the integrity of the project, which may include:	• design styles • durability and available design life • energy costs • labour costs • material costs • safety factors • speed of installation • suitable materials • system choices.
Statutory and regulatory requirements may include:	• Acts and regulations • Australian and New Zealand standards, including AS/NZS3500 National plumbing and drainage set: Parts 4.1 and 4.2 • Building Code of Australia • local and state government policies, including group and strata titling.
Manufacturer requirements may include:	• material specifications • pump tables • sizing tables • technical and trade manuals.
Desktop study can include collection and interpretation of existing data for design purposes from:	• architectural and building plans • council plans • developer plans • other documents, including: • applications

RANGE STATEMENT

	• forms • sewer detail maps • other reports as available.
Performance requirements include:	• those established using Australian and New Zealand standards and local authority plans.
Layout of pipework systems may include:	• dead leg systems • pumped systems • thermo convection systems.

Fittings and valves may include:	• fittings:
	  • bends
	  • tees
	  • unions
	  • valve trains
	• valves:
	  • backflow prevention
	  • cold water expansion
	  • isolating
	  • non-return, including high pressure non-return
	  • pressure limiting
	  • pressure relief
	  • strainers.

Thermostatic mixing valves and tempering valves may include:	• alcohol • bimetallic types • wax capsule.
Circulating heated water supply system details may include:	• circulating pump specification • dead leg minimisation • flow and return pipework • speed of circulation • thermal convection circulating systems.
Heat trace systems may include:	• cost • installation requirements.
Calculations for sizing water heaters may include:	• coefficient of expansion • daily flows • energy calculations • heat loss calculations • mixed temperature calculations • peak demand

RANGE STATEMENT

	• recovery times • size and quantity of heated water required • standby versus continual flow • tariff calculations • water expansion calculations.
Methods for the control of expansion may include:	• bends • lyre loops and full loops • offsets • proprietary expansion control devices.
Pipe fixings may include:	• anchors • bracket spacing • corrosion protection • hanging brackets • material requirements • saddles • wall and ceiling brackets.
Manifolding heated water units may include:	• balanced flow conditions and valves • pressure relief requirements.
Water heaters may include:	• continuous flow • electric • gas • heat transfer • high pressure • low pressure • other fuel sources • solar • storage • vented atmospheric pressure systems.
Safe trays and overflows may include:	• above habitable areas • heights • materials • sizes • space requirements.
Materials may include:	• composite pipe materials and other pipe materials as specified • copper • fittings and fixtures • polybutylene.
Jointing methods may include:	• brazing

RANGE STATEMENT

	• compression • flaring • mechanical joints • threading.
Insulation materials may include:	• density • diameter • felt • fibre glass • foam • heat losses • heat transmission processes • rock wool • thickness.
Installation requirements may include:	• clipping • installation details • jointing requirements • level of workmanship.
Circulating systems may include:	• approved pressure pipes and fittings • calculated rise and pump delivery requirements • pump sizing to meet calculated flow conditions.

Plans:	• may include:
	  • axonometrics
	  • cross-sections
	  • details
	  • elevations
	  • isometrics
	  • schematics
	  • sections
	• may be produced using:
	  • computer generation
	  • Indian ink
	  • pencil
	  • pigment liner.

Specification may include:	• bedding • clipping • concrete support • jointing

RANGE STATEMENT

	• manholes • manufacturer requirements • materials • workmanship.
Testing may include:	• air pressure test • hydrostatic test • quality assurance (QA) audit.
Commissioning schedule may include:	• balancing the system • checking and flushing the system • temperature setting.
Operation and maintenance manual may include:	• check for blockages • leak detection • pump maintenance • water auditing • yearly inspection • yearly maintenance requirements.

Unit Sector(s)

Unit sector Plumbing and services

Co-requisite units

Co-requisite units Nil

Functional area

Functional area