



Australian Government

CPCPCM5011A Design complex cold water systems

Release 1

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Modification History

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

Not equivalent to CPCPCM5001A

Unit Descriptor

This unit of competency specifies the outcomes required to design complex cold water distribution systems in multi-storey buildings, including pressure, gravity feed, pumped systems and storage regulations.

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 construction hydraulics.

Application of the unit is relevant to multi-storey residential, commercial and industrial buildings with or without connection to reticulated water supply.

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 the distribution of complex cold water systems for wide span and high-rise building projects. |
| | | 1.2 | <i>Design requirements</i> 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 materials and system designs. |
| | | 1.4 | <i>Statutory and regulatory requirements</i> for the design of complex cold water distribution systems are interpreted. |
| | | 1.5 | <i>Australian standards and codes</i> for the design of complex cold water distribution systems are analysed and applied. |
| | | 1.6 | <i>Manufacturer requirements</i> and trade and technical manuals are interpreted. |
| | | 1.7 | Additional research, including a <i>desktop study</i> , is conducted to outline design parameters. |
| | | 1.8 | <i>Flow and pressure tests</i> are conducted. |
| | | 1.9 | <i>Performance requirements</i> are established, considering safety of system users or building occupants. |

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|---|------------------------------------|-----|---|
| 2 | Plan and detail system components. | 2.1 | Layout of pipework systems , type and location of fittings and valves , and acoustic performance of the system are planned. |
| | | 2.2 | Type, location and requirements for backflow prevention devices are detailed. |
| | | 2.3 | Flush valve system types and operation are specified. |
| | | 2.4 | Pipe sizes, velocities, flows and residual pressures are calculated for a range of applications. |
| | | 2.5 | Cold water system components are detailed or designed. |
| | | 2.6 | Pump, pump controls and pumphouse requirements are sized and detailed. |
| | | 2.7 | Approved materials, jointing methods and installation requirements for complex cold water distribution systems are specified. |
| 3 | Design and size systems. | 3.1 | Complex cold water distribution systems are designed for a range of wide span and high-rise building applications. |
| | | 3.2 | Flush valve distribution systems for sanitary ablutions are designed. |
| | | 3.3 | Range of delivery systems is designed. |
| | | 3.4 | Complex cold water distribution systems are designed and sized using computer software packages. |
| | | 3.5 | 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 and specifications are prepared for a range of complex cold water distribution systems. |
| | | 4.3 | Testing and commissioning schedule is prepared. |
| | | 4.4 | 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:
 - read and interpret:
 - plans, specifications, drawings and design briefs
 - standards and manufacturer requirements and manuals
 - statutory and regulatory requirements
 - produce written documents, including:
 - plans, specifications and schedules
 - operation and maintenance manual
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of complex cold water systems
 - take initiative and make decisions
- problem-solving skills to analyse requirements, consider options and design an appropriate system
- 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

- AS/NZS3500 National plumbing and drainage
- AS2200 Design charts for water supply and sewerage
- common terminology and definitions used in design of cold water reticulation systems
- National Construction Code
- nature of materials used and effects of performance under various conditions
- other relevant Australian standards, codes or standard operating procedures
- principles of technology used in design of cold water reticulation and hydrant and hose reel systems for all classes of building
- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- water quality requirements
- 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 drainage principles and detailing of system components used in the drainage industry.

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 cold water supply
 - a non-drinking supply system
 - a flush valve system
- evaluate and document design parameters, including client, regulatory, manufacturer and Australian standard and code requirements for a range of complex water supply systems
- evaluate health risks associated with the drinking and non-drinking water supplies
- apply regulatory, manufacturer and relevant Australian standard and code requirements for a range of complex cold water distribution systems
- plan and detail system components, including:
 - authority's connection
 - backflow prevention requirements
 - fixtures and fittings
 - flush valves

- meter assemblies
- storage tanks
- piping systems
- pumps
- comply with WHS regulations applicable to workplace operations
- apply organisational quality procedures and processes
- design and size cold water distribution and delivery systems
- design and size flush valve systems
- prepare a specification for the cold and non-drinking water distribution system
- prepare a testing and commissioning schedule
- prepare an operation and maintenance manual
- apply correct design principles and techniques
- 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 workplace 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 complex cold water 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 may include:

- architectural plans
- building specifications
- effect of water quality on pipework, plant and equipment
- owner requirements
- pipework and valve identification
- soil quality
- specialist water use applications
- unstable or water-charged ground.

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:
 - expected design life
 - labour costs
 - material costs
 - safety factors
 - speed of installation
 - suitability of materials

- system choices.

Statutory and regulatory requirements may include:

- local and state government requirements
- preparation of documentation for authorities' approval
- requirements of Acts and regulations.

Australian standards and codes may include:

- AS/NZS3500 National plumbing and drainage
- AS2200 Design charts for water supply and sewerage
- National Construction Code
- state or territory requirements
- other relevant Australian standards or codes.

Manufacturer requirements may include:

- flow and pressure requirements for fixtures and appliances
- material specifications
- pump tables
- sizing tables
- recommended specific fixings for pipework
- technical and trade manuals.

Desktop study may include collection and interpretation of existing data for design purposes, such as:

- architectural and building plans
- manufacturers' data
- developer plans
- documents, which may include:
 - applications
 - brochures
 - forms
 - policies
 - other reports as available.

Flow and pressure tests must include:

- on-site measurement of flow (l/s), velocity (m/s) and pressure (kPa)
- interpretation of flow and pressure tests conducted by a contractor.

Performance requirements may

- flow, velocity, pressure and discharge requirements, established using relevant Australian

include: standards, codes, and state, territory and local government authorities' plans.

Layout of pipework systems may include:

- principles of economy, serviceability, durability and fit for use
- dual feed
- gravity feed
- main pressure
- pumped system
- ring main.

Fittings and valves may include:

- fittings:
 - bends
 - elbows
 - tees
 - unions
- valves:
 - backflow prevention
 - excess pressure
 - isolating
 - pressure limiting
 - pressure reduction
 - strainers.

Backflow prevention devices may include:

- registered break tank (RBT)
- registered air gap (RAG)
- double-check valve assembly (DCV)
- dual-check valve with intermediate vent (DuCV)
- reduced pressure detector assembly (RPDA)
- reduced pressure zone device (RPZD)
- other approved devices.

Flush valve system types may include:

- backflow prevention requirements
- gravity
- mains pressure
- pipe sizing requirements
- storage requirements.

Cold water system components may involve:

- meter assemblies that may be:
 - direct and indirect
 - electronic
 - inferential
 - magnetic
- thrust blocks and their design elements, including:
 - design details for tees, elbows and valves
 - keying and anchorage points
 - sizes
 - soil characteristics
 - velocity and flow forces to be resisted
- pipe supports, including:
 - anchors
 - bedding
 - bracket spacing
 - corrosion protection
 - cover
 - hanging brackets
 - manufacturer-recommended specific fixings
 - material requirements
 - provision for expansion
 - saddles
 - wall and ceiling brackets
- water storage systems, including:
 - air gap
 - automatic controls
 - drain down provision
 - inlet valve design and sizing
 - outlet sizing
 - overflow requirements
 - provision to maintain service while cleaning
 - provision to maintain service while servicing
 - safe tray requirements
 - tank access
 - tank maintenance
 - tank sizes
- water treatment, including:
 - filtration
 - reverse osmosis (RO)

- softening.

Pump, pump controls and pumphoom requirements must include:

- acoustic performance
- automatic changeover
- automatic controls
- drain down provision
- dual pump provision
- impeller sizing
- inlet and outlet design requirements
- installation and mounting requirements
- pressure gauges
- pump selection
- pump sizing
- space requirements
- valve requirements
- variable speed control.

Materials may include:

- acrilonitrile butadiene styrene (ABS)
- composite pipework
- copper (Cu)
- cross-linked polyethylene (PE-X)
- polypropylene (PP)
- polybutylene (PB)
- ductile iron cement lined (DICL)
- other approved materials
- fittings and fixtures
- protective coatings.

Jointing methods may include:

- brazing
- compression
- electrofusion welding
- flaring
- mechanical joints
- rubber ring joints
- screwing
- soldering
- solvent cement welding
- other approved jointing methods.

Installation requirements must include:

- bedding
- fire rating of penetrations
- clipping
- installation details
- jointing requirements
- level of workmanship
- manufacturer-recommended specific fixings
- pipe support.

Delivery systems may include:

- constant flow variable speed pumps
- gravity feed
- hydropneumatic
- mains pressure system.

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
 - effect on the environment due to overflow or leakage
 - 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:

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

Testing may include:

- air pressure
- defect inspection
- hydrostatic
- mains pressure
- performance
- quality assurance (QA) audit.

Commissioning schedule may include:

- disinfection
- flow test
- leak check
- pressure test
- system certification
- system defects
- system functions as per design
- system purge
- valve operation.

Operation and maintenance manual may include:

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

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.