



Australian Government

CPCPCM5010A Design complex sanitary plumbing and drainage 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 CPCPCM5000A

Unit Descriptor

This unit of competency specifies the outcomes required to undertake the hydraulic engineering design of complex sanitary plumbing and drainage installation and to prepare specifications for a range of residential, commercial and industrial buildings.

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.

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. | <p>1.1 <i>Scope of work</i> is established for complex sanitary plumbing and drainage systems for wide span and high-rise building projects.</p> <p>1.2 <i>Design requirements</i> are determined from relevant Australian standards, codes, plans, specifications and client brief.</p> <p>1.3 <i>Cost-benefit analysis</i> is conducted comparing a range of pipe materials and system designs.</p> <p>1.4 <i>Statutory and regulatory requirements</i> for the design of complex sanitary plumbing and drainage systems are interpreted.</p> <p>1.5 <i>Australian standards and codes</i> for the design of complex sanitary plumbing and drainage systems are analysed and applied.</p> <p>1.6 <i>Manufacturer requirements</i> and trade and technical manuals are interpreted.</p> <p>1.7 Additional research, including a <i>desktop study</i>, is conducted to outline design parameters.</p> <p>1.8 <i>Performance requirements</i> are established, considering safety of system users or building occupants.</p> |
| 2 | Plan and detail system components. | <p>2.1 <i>Layout of pipework systems</i> and type and location of <i>fittings and valves</i> are planned.</p> <p>2.2 <i>Access chambers</i> and <i>gullies</i> are designed and detailed.</p> <p>2.3 Pipe sizes, pipe grades, and trapping and ventilation</p> |

- requirements are *calculated* for a range of applications.
- 2.4 *Anchor blocks* are designed for a range of applications.
- 2.5 *Pipe support* is designed for a range of applications.
- 2.6 *Pumpwell, pump and pump control requirements* are sized and detailed.
- 2.7 Approved *materials, jointing methods* and *installation requirements* for complex sanitary plumbing and drainage systems are specified.
- 2.8 Acoustic performance of the sanitary plumbing and drainage system is included in the design.
- 3 Design and size systems.
- 3.1 Complex sanitary plumbing and drainage systems are designed for a range of wide span and high-rise building applications.
- 3.2 *Rising main systems* are designed.
- 3.3 Complex sanitary plumbing and drainage 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 sanitary plumbing and drainage systems.
- 4.3 *Specification* for complex sanitary plumbing and drainage systems is prepared.
- 4.4 *Testing and commissioning schedule* is prepared.
- 4.5 *Operation and maintenance manual* is produced.

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 and to communicate with others to ensure safe and effective work practices
 - use clear and direct questioning to:
 - identify and confirm requirements
 - listen and understand
 - share information
 - use and interpret non-verbal communication
 - use language and concepts appropriate to cultural differences
- 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:
 - manufacturer requirements and manuals
 - plans, specifications, drawings and design briefs
 - standards
 - statutory and regulatory requirements
 - produce written information, including:
 - documentation, such as plans, specifications and schedules
 - an operation and maintenance manual
- planning and organising skills to:
 - research, collect, organise and understand information relating to the design of complex sanitary and plumbing drainage 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 complex sanitary plumbing and drainage systems for all classes of building
- National Construction Code
- other relevant Australian standards, codes or standard operating procedures
- principles of technology in the design of hydraulic systems
- procedures for maintaining air balance within the systems
- requirements of state regulatory authorities, Australian standards and manufacturer specifications, including hazards identified in relation to devices and systems used
- workplace safety 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 carrying out the effective performance and application of drainage principles and detailing 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 of a complex sanitary plumbing and drainage system, including a specification for a high rise mixed development building; using two approved sanitary plumbing systems, to an effective height above 25 metres, inclusive of a basement, to include fixtures on each floor level (fixtures are included in the basement) and:
 - applying sustainability principles and concepts throughout to achieve a star rating under the Green Building Council of Australia rating scheme
 - evaluating and documenting design parameters, including client, regulatory, manufacturer and relevant Australian standard and code requirements for a range of complex sanitary plumbing and drainage systems
 - evaluating health risks associated with the sanitary plumbing and drainage system
 - planning and detailing system components, including:
 - access chambers (manholes)
 - gullies
 - anchorage blocks

- pumpwells
- piping systems
- designing and sizing a complex sanitary plumbing and drainage system
- applying drainage principles in the design and sizing of a complex elevated pipe system
- designing and sizing a rising main
- designing and sizing a fully vented or fully vented modified system
- designing and sizing a single stack or single stack modified system
- preparing plans to industry standards for a range of complex sanitary plumbing and drainage systems
- preparing a specification for a complex sanitary plumbing and drainage system
- preparing a testing and commissioning schedule
- preparing an operation and maintenance manual
- complying with WHS regulations applicable to workplace operations
- communicating 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
 - sizing and documenting layout of complex sanitary plumbing and drainage systems for applications, including residential, commercial and industrial
- may be for:
 - existing structure being renovated, extended, restored or maintained
 - new projects.

Design requirements may include:

- architectural plans
- building specifications
- fire rating of penetrations
- owner requirements
- pipework identification
- soil quality
- specialist waste 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 integrity of the project
- may include:
 - design styles
 - expected design life
 - labour costs
 - material costs

- safety factors
- speed of installation
- suitability of materials
- system choices.

Statutory and regulatory requirements may include:

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

Australian standards and codes may include:

- AS/NZS3500 National plumbing and drainage
- state or territory requirements
- National Construction Code
- other relevant Australian standards and codes.

Manufacturer requirements may include:

- material specifications
- 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, such as:

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

Performance requirements must include:

- flow, velocity, pressure and discharge requirements, established using relevant Australian standards, codes and local authority plans.

Layout of pipework systems:

- will be based on principles of economy, serviceability, durability and fit for use
- may include:

- drainage
- elevated pipework
- low pressure pump
- vacuum
- vented stack systems.

Fittings and valves may include:

- bends
- junctions
- air admittance valves
- reflux valves
- inspection openings
- expansion joints.

Access chamber details may include:

- benching requirements
- flow
- gradient requirements
- inlet and outlet connections
- ladder access
- lids
- open and closed channel
- sizing.

Gullies can cover details such as size, location, bedding and concrete support, and also include:

- boundary traps
- disconnector gullies (DG)
- floor waste (FW)
- overflow relief gullies (ORG).

Calculations for complex sanitary plumbing and drainage systems may include:

- determination of flow and fixture loadings
- gradient calculations
- interpretation of design charts and tables
- pipe sizing calculations
- reduced level calculations
- self-cleaning velocities.

Anchor blocks design elements may include:

- flow forces to be resisted
- keying and anchorage points
- sizes
- soil characteristics.

Pipe supports may include:

- anchors
- bedding
- bracket spacing
- concrete support
- corrosion protection
- cover
- hanging brackets
- manufacturer-recommended specific fixings
- material requirements
- provision for expansion
- saddles
- wall and ceiling brackets.

Pumpwell, pump and pump control requirements may include:

- access covers
- automatic controls
- capacity
- chains
- corrosion-resistant materials
- detailing
- emergency storage
- high and low-level water controls and alarms
- impeller sizing
- inlet and outlet design requirements
- installation and mounting requirements
- ladder access
- macerator requirements
- odour control
- pump selection
- pump sizing
- pumpwell sizing
- space requirements
- step irons
- valve requirements
- ventilation
- warning system.

Materials may include:

- cast iron (CI)
- concrete
- copper (CU)

- earthenware (VCP)
- high density polyethylene (HDPE)
- unplasticised polyvinyl chloride (PVC-U)
- other approved material
- fittings and fixtures, including:
 - measures to prevent the spread of fire
 - sound attenuation requirements.

Jointing methods may include:

- brazing and threading
- electrofusion welding
- mechanical joints
- rubber ring
- solvent cement welding.

Installation requirements must include:

- bedding
- clipping
- concrete support
- fire rating of penetrations
- installation details
- jointing requirements
- level of workmanship.

Rising main systems may include:

- approved pressure pipe and fittings
- calculated rise and pump delivery requirements
- pipe velocities
- 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
 - effect on the environment due to overflow or leakage
 - water efficiency
 - consideration of the Green Building Council of Australia rating scheme
 - local environment consideration regarding

overflow, disposal and reuse.

Plans:

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

Specification may include:

- bedding
- commissioning
- concrete support and detailing specialised components
- jointing
- access chambers (manholes)
- manufacturer requirements
- materials
- pumps
- safety (WHS)
- support
- testing
- workmanship.

Testing may include:

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

Commissioning schedule may include:

- charging traps
- checking leaks
- checking for foreign material
- checking for system defects
- checking that system functions as per design

- checking trap water seal retention
- cleaning grates
- system certification.

Operation and maintenance manual may include:

- construction drawings
- results of commissioning test
- certification documentation
- maintenance schedules
- manufacturer brochures and technical information
- manufacturer warranties.

Unit Sector(s)

Functional area

Unit sector Plumbing and services

Custom Content Section

Not applicable.