



Australian Government

Department of Education, Employment and Workplace Relations

CPCPCM5000A Design complex sanitary plumbing and drainage systems

Release: 1

CPCPCM5000A Design complex sanitary plumbing and drainage systems

Modification History

Not Applicable

Unit Descriptor

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.
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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 construction hydraulics.
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Licensing/Regulatory Information

Not Applicable

Pre-Requisites

Prerequisite units	Nil
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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 complex sanitary plumbing and drainage 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 sanitary plumbing and drainage systems are interpreted. 1.5. Australian and New Zealand standards for the design of complex sanitary plumbing and drainage systems are analysed and applied. 1.6. Manufacturer requirements and trade and technical manuals are interpreted. 1.7. Additional research including a desktop study is conducted. 1.8. 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. Manholes and gullies are designed and detailed. 2.3. Pipe sizes, pipe grades, and trapping and ventilation requirements are calculated for a range of applications. 2.4. Anchor blocks are designed for a range of applications. 2.5. Pipe fixings are 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.
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.
4. Prepare	4.1. Plans are prepared for a range of complex sanitary

ELEMENT	PERFORMANCE CRITERIA
documentation.	plumbing and drainage systems. 4.2. Specification for complex sanitary plumbing and drainage systems 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:

- clear and direct communication, using 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
- communication skills to confirm job specifications and client requirements and to communicate with others to ensure safe and effective work practices
- 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 complex sanitary and plumbing drainage systems
 - take initiative and make decisions
- problem solving skills to analyse requirements, consider options and design an appropriate system
- reading skills, including the ability to read and interpret:
 - manufacturer requirements and manuals
 - plans, specifications, drawings and design briefs
 - standards
 - statutory and regulatory requirements
- written communication skills to:
 - prepare documentation, including plans, specifications and schedules

REQUIRED SKILLS AND KNOWLEDGE

- produce an operation and maintenance manual
- 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:

- AS/NZS3500 National plumbing and drainage set
- 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
- other standards, codes or standard operating procedures
- principles of technology in the design of hydraulic 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

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:

- evaluating and documenting design parameters, including client, regulatory, manufacturer and Australian and New Zealand standard requirements for a range of complex sanitary plumbing and drainage systems
- planning and detailing system components, including:
 - 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

EVIDENCE GUIDE

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 OHS regulations applicable to workplace operations
- interactive communication 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 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.

EVIDENCE GUIDE

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

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:

- includes:
 - 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 specifications
- builder specifications
- owner requirements
- specialist water use applications.

Cost-benefit analysis may include:

- comparison of range of suitable materials and system choices available to enable cost-effective choices to be made without compromising integrity of the project.

Statutory and regulatory requirements include:

- Acts and regulations
- local and state government policies.

Australian and New Zealand standards may include:

- AS/NZS3500 National plumbing and drainage set: Parts 1.1 and 1.2
- AS2200 Design charts for water supply and sewerage
- Building Code of Australia.

Manufacturer requirements may include:

- material specifications
- pump tables
- sizing tables
- technical and trade manuals.

Performance requirements

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

RANGE STATEMENT

include:	New Zealand standards and local authority plans.
Layout of pipework systems may include:	• dual feed • ring main • single pipe.
Fittings and valves may include:	• fittings: • bends • elbows • tees • unions • valves: • backflow prevention • excess pressure • isolating • pressure limiting • pressure reduction • strainers.
Manhole details may include:	• benching requirements • connections to and from • flow • gradient requirements • inspection chambers • 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) • 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.
Anchor blocks design elements may include:	• flow forces to be resisted • keying and anchorage points • sizes • soil characteristics.
Pipe fixings may include:	• anchors • bedding

RANGE STATEMENT

Pumpwell, pump and pump control requirements may include:

- bracket spacing
- concrete support
- corrosion protection
- cover
- hanging brackets
- material requirements
- saddles
- wall and ceiling brackets.
- automatic controls
- capacity
- chains
- corrosion-resistant materials
- detailing
- high and low-level water controls and alarms
- impeller sizing
- inlet and outlet design requirements
- installation and mounting requirements
- ladder access
- macerator requirements
- pump selection
- pump sizing
- pumpwell sizing
- space requirements
- step irons
- valve requirements
- warning system.

Materials include:

- cast iron
- concrete
- copper
- earthenware
- high density polyethylene (HDPE)
- unplasticised polyvinyl chloride (PVC-U)
- fittings and fixtures, including:
 - measures to prevent the spread of fire
 - sound attenuation requirements.

Jointing methods may include:

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

RANGE STATEMENT

- Installation requirements** include:
- bedding
 - clipping
 - concrete support
 - installation details
 - jointing requirements
 - level of workmanship.
- Rising main systems** may include:
- approved pressure pipe 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 and detailing specialised components
 - jointing
 - manholes
 - manufacturer requirements
 - materials
 - workmanship.
- Testing** may include:
- air pressure test
 - drainage inspection
 - hydrostatic test
 - quality assurance (QA) audit.
- Commissioning schedule** may include:
- charging traps
 - checking leaks

RANGE STATEMENT

Operation and maintenance manual may include:

- cleaning grates.
- 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